49TH CONGRESS, 1st Session. SENATE. EX. DOC. No. 12.

BRIDGES, ETC., INTERFERING WITH NAVIGATION.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

In compliance with law, reports relating to causeways, bridges, &c., in process of erection that may interfere with navigation.

DECEMBER 21, 1885.—Referred to the Committee on Commerce and ordered to be printed.

WAR DEPARTMENT,
Washington City, December 18, 1885.

The Secretary of War has the honor to transmit to the United States Senate, in compliance with section 2 of the river and harbor act of July 5, 1884, a letter from the Chief of Engineers, dated the 12th instant, and its accompanying copies of reports from officers of the Corps of Engineers, relating to bridges, causeways, or structures now erected or in process of erection which do or will interfere with free and safe navigation.

WM. C. ENDICOTT,
Secretary of War.

The PRESIDENT PRO TEMPORE OF THE UNITED STATES SENATE.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 12, 1885.

SIR: Section 2 of the river and harbor act of July 5, 1884, requires of the Secretary of War, that—

> He shall also report [to Congress] whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and, if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions.

With the view of supplying the information desired, officers under the direction of this office were instructed to submit reports covering all facts necessary to enable the Secretary of War to comply with the

terms of the extract above quoted. Reports have been received from officers in charge of river and harbor districts, and I have the honor to submit herewith copies of such of them as report instances of bridges, causeways, or structures now erected or in process of erection that do or will interfere with free and safe navigation, with recommendations as to the best mode of altering or constructing them as will prevent any such obstructions.

All other officers report that there are no instances in their respective districts of interference with free and safe navigation from the above-mentioned causes.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. W. C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR CHARLES W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., January 27, 1885.

GENERAL: In compliance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, dated July 23, 1884, I have the honor to submit the following report with reference to obstructions to navigation in the district under my charge, as specified in sections 2 and 8 of the river and harbor act of July 5, 1884.

A sketch map* showing the location of bridges referred to in the report is also respectfully transmitted herewith.

* * * * * * *

A careful study has been made of all the bridges in the district. Those which interfere with free and safe navigation cross either the Fort Point channel or Charles river, (which enter the upper harbor of Boston,) and are as follows:

(1) FORT POINT CHANNEL.

a. The New York and New England Railroad bridge interferes with free and safe navigation. This arises from three causes.

(*a*) Its draw-openings are too narrow. The bridge is situated between the Congress Street and Mount Washington Avenue bridges, (A and C on plan,) being 500 feet from the first and 1,100 feet from the second. (See B on plan.) Its draw-openings are 40 feet 7 inches wide, being about 1 foot 7 inches narrower than those of bridge C, and nearly 3 feet narrower than those of bridge A. Some vessels drawing from 20 to 22 feet, which could pass bridges A and C at average height water, cannot pass this bridge; hence, the sugar-refineries using wharves located above bridge C are prevented from employing such vessels.

The best mode of altering this bridge so as to prevent this obstruction is to widen the draw-openings to a least width of 42½ feet. The cost of this alteration would probably not exceed $3,000. It would require the suspension of travel across the bridge for several days.

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*Omitted.

(*b*) The direction of the draw-pier does not conform with those of the piers of the neighboring bridges; consequently, vessels having passed at ebb-tide through the draw-opening on the Boston side (where at present the water is deepest) are in danger of colliding with the upper end of the draw-pier of the Congress Street bridge.

The best mode of altering this bridge so as to prevent this obstruction is to reconstruct the lower part of the draw-pier so as to align it with those of the neighboring bridges. This would cost about $5,000, and can be done without stopping travel across the bridge.

(*c*) Complaints have been made that vessels are often delayed because the draws of this bridge are not promptly opened. This is due to the many trains which pass the bridge in quick succession.

Under the law of the State of Massachusetts, a railroad-train is allowed fifteen minutes before and after its tabular time, and any approaching train further reasonable time for crossing a draw-bridge; hence, where many trains are run at short intervals, the draw may be continuously closed for many hours.

No alteration of the bridge can overcome this difficulty. The inconvenience might, perhaps, be somewhat lessened by a change in the State law.

If the project for deepening the Fort Point channel to 23 feet at mean low water is carried out, as recommended in my report dated January 27, 1885, more extensive changes than those above indicated must be made in this bridge, since its piles extend only to 22 feet below mean low water. It does not, therefore, seem desirable to urge immediate action.

b. The Old Colony railroad bridge interferes with free navigaton on account of the delay in opening its draws, due to the great number of trains passing over it. No alteration in the bridge is necessary.

(2) CHARLES RIVER.

The seven draw-bridges situated between the river's mouth and East Cambridge (marked D, E, F, G, H, I, J, K on map*) interfere with free navigation, owing to their proximity to each other. Although the problem of rearranging and modifying these bridges has been often and thoroughly investigated, no practical plan consistent with the necessities of the railroad and city travel has been developed.

The most serious obstructions to the navigation of the river are the railroad bridges, (marked F, G, H, I, J on map.*) The frequent passing of trains renders delays in opening the draws unavoidable. The inconvenience is greatest in connection with the Boston and Maine Railroad bridge, (marked G on map, *) and the consolidated bridge of the Eastern and Boston and Lowell railroads, (marked H, I on map,*) which has two independent draw-sections. These bridges are so near together that it is necessary for the passage of a vessel of the larger class navigating the river to have the three draws open at the same time. The time-tables of the three railways not being arranged with a view to facilitate navigation, this coincidence of openings is often impossible, and long delays occur. It is almost a rule for the draws of the Eastern Railroad bridge to be closed from four to five hours at a time in the morning, and about as many hours in the afternoon. In-

*Omitted.

stances have been reported where as many as twenty-two vessels have been thus detained for many hours.

These difficulties cannot be obviated by any practicable alteration of the bridges. Some improvement could be obtained by introducing steam-power for moving the draw-sections, but the benefit would be comparatively so slight that it does not appear to justify the trouble and expense.

The obstruction to navigation arising from the bridges crossing the Fort Point channel and the Charles river, above specified, cannot be removed or diminished by the construction of booms, dikes, piers, or any other structures for the guiding of vessels.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUT. COL. GEORGE H. ELLIOT, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
Newport, R. I., December 8, 1884.

GENERAL: Referring to General Order No. 13, Headquarters Corps of Engineers, current series, * * * respecting the interference with free and safe navigation of bridges and other structures within my district, I have to state I have visited Pawtucket (Seekonk) River, and submit the following report concerning the two bridges which cross that river just above its confluence with Providence River:

THE WASHINGTON BRIDGE.

This highway bridge, originally built in 1793, was rebuilt in 1815, with a draw, opening close to the eastern end of the bridge. By reason of this location and of the width of the draw-span, only 38 feet, and the insufficient depth of water through it, this bridge is a great obstruction to navigation, but the State legislature, at its January session of 1883, enacted a law requiring the city of Providence to remove—

The stone and other materials deposited in the Seekonk River under and near Washington bridge, so called, at India Point, in said city (Providence) from said river, and cause the channel thereof under and around said bridge to be dredged and cleared of all obstructions to the flow of the tides into and out of said river, to a depth of 15 feet at low water, and reconstruct said bridge with a swing-draw in the main channel of said river, with an opening on each side of said draw not less than 80 feet wide, for the safe and convenient passage of vessels navigating said river through the same, in such manner as the harbor commissioners shall approve.

The new bridge is now in process of construction, and it is expected that it will be completed and the old bridge and the obstructions at and about it will be removed by the 1st of May next.

THE RAILROAD BRIDGE.

About 250 feet below the Washington bridge is the railroad bridge of the Boston and Providence Railroad Company. I quote from the annual report of the late General Warren for 1874 the following descrip-

tion of this bridge and the present arrangements for the passage of vessels through its draw:

This bridge is 396½ feet long, divided into three spans and a draw. Commencing on the west side, there is, first, a span of 113 feet; next, one of 108½ feet; next is the draw, 154 feet, with openings of 60 feet in the clear; and last, a short span of 20¾ feet, one end of which rests on a stone pier, the only one in the bridge, the other end resting on the abutment. The superstructure is a Howe truss. * * * To facilitate the passage of vessels through this and Washington bridge, double lines of piling have been put in between the draws of the two bridges. This piling has been extended about 300 feet above Washington bridge, and one line has bene extended about the same distance below the railroad bridge. The space between these lines of piles varies from 38 to 60 feet. Vessels going up the river enter this passage at an angle with the current, and pass the railroad bridge at an angle of 20 degrees with the axes of the piers. When they reach Washington bridge, a turn must be made to the left of about 45 degrees. This turn has to be in the draw of the bridge, where the passage is only 38 feet wide. These vessels pass up the river at high water, when there is but little current. They cannot tow through safely because of the sharp turn above alluded to, but have to warp through and make up the tow above. In descending they generally leave Pawtucket after the tide commences to run out, and reach these bridges when the current is very swift, often as much as 5 miles per hour. To break up a tow in a current like this, so as to enable the vessels to warp through, would be attended with great danger of being carried down onto the bridge to the west of the draw. Their only course is to be taken through by the tug, and this must be done at a speed greater than the current, in order to keep steerage-way. In making this passage they are very frequently damaged by coming in contact with the piling. Once in the passage there is no escape, except with the current at the lower end.

The *width* of the draw-openings in the railroad bridge was directed by the act of the legislature which authorized the construction of the bridge. Their *location* was doubtless selected to suit, as far as possible, the location of the draw in the old Washington bridge.

The combined obstruction furnished by the Washington bridge and the railroad bridge is a very serious one, as will be seen from the plat* herewith.

It has for many years been the cause for much complaint by the citizens of the enterprising town of Pawtucket, which is situated about 4 miles above the bridges, and is extensively interested in manufactures which depend on water transportation, and it has delayed for years, appropriations by the General Government for the improvement of Pawtucket river. Neither the location nor the plans of these bridges, received the sanction of Congress, and I may also remark that this is the case also with the new bridge which is now building above the present site of the Washington bridge. The location, and the width of the draw-openings of the new bridge seem to be judiciously arranged, and when it is completed it is barely possible that the railroad company can by dredging below its bridge so as to carry the channel further to the eastward, and by a new arrangement of the guides to its western draw-opening, facilitate sufficiently for the present the passage of vessels, but for the following reasons I do not deem this probable.

The new highway bridge and the railroad bridge are only about 500 feet apart. There is only one available draw-opening in the railroad bridge. It is but 60 feet wide, and 15 feet of this width is taken up by the oblique guides through the draw. When the new highway bridge is completed and the guides at the railroad bridge draw are newly arranged to suit the new location of the draw in the highway bridge,

* Plat omitted.

the available width of the draw-opening in the railroad bridge can be somewhat increased, but in any case it cannot be made much more than 50 feet. The draw-openings in the new highway bridge are neither of them opposite the single available draw-opening in the railroad bridge. The *western* side of this opening is about 20 feet to the *eastward* of the western side of the *eastern* draw-opening in the new highway bridge, and just below the railroad bridge the river makes a sharp turn to the westward.

To sum up: There is but one available draw-opening in the railroad bridge. It is too narrow, and there should be two. It is so far to the eastward that the passage of vessels through the bridges will be tortuous and, when the tide is running, dangerous. It will doubtless be found necessary to remove the draw-openings in this bridge to the westward, so that they will be opposite or nearly opposite the draw-openings in the new highway bridge, and to increase the width of the former to 80 feet, which is the width of the latter; but action by the General Government may be delayed in this case until the new highway bridge is finished and we can see the result of the change in location of its draw. This is in consideration of the possibility before mentioned, and of the fact that the legislature of Rhode Island, at its last session, enacted the following law looking to the modification of the draw of the railroad bridge by State direction, if it be found necessary after investigation by the committee provided for in the act:

RESOLUTION appointing a joint special committee on the obstructions in the Seekonk River below the site of the Providence Washington bridge. } No. 4, passed May 29, 1884.

Resolved, That a joint special committee consisting of Messrs. William W. Blodgett, of Pawtucket, William A. Harris, of Providence, and Ellery H. Wilson, of East Providence, on the part of the house of representatives, and Messrs. Henry B. Metcalf, of Pawtucket, John P. Gregory, of Lincoln, and Edward C. Dubois, of East Providence, on the part of the senate, be appointed to inquire into and report what obstructions to the navigation of the Seekonk river exist below the site of the present Providence Washington bridge, and what, if anything, ought to be done to effect the removal of such obstructions; that said committee be authorized to sit during the recess, and be directed to report in print, by bill or otherwise, to the general assembly at the January session, A. D. 1885.

With this report I submit copies of letters respecting the obstruction to navigation caused by the railroad bridge, which I have received from citizens of Pawtucket, and also a plat,* for which I am indebted to the courtesy of Capt. J. P. Cotton, one of the commissioners and the engineer of the new bridge, showing the present location of the Washington highway bridge, the new location of this bridge, and the location of the railroad bridge.

Very respectfully, your obedient servant,

GEORGE H. ELLIOT,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

LETTER OF THE PRESIDENT OF THE TOWN COUNCIL OF PAWTUCKET, RHODE ISLAND.

PAWTUCKET, R. I., *August* 16, 1884.

DEAR SIR: Yours of 2d instant was duly received, but have delayed answering, as Mr. George E. Newell, who has been appointed by the governor as one of the commissioners to construct a new bridge in place of the Washington bridge, has been out of the State.

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*Omitted.

There are no causeways or structures now erected or in process of erection that will interfere with the free and safe navigation of the Pawtucket River, except the Washington bridge and railroad bridge near its mouth. A new bridge is in process of erection in place of the Washington bridge, with good and sufficient draw-openings. The railroad bridge, with insufficient draw-openings, is a serious obstruction to navigation, and could be remedied by making a wider draw nearer the centre of the river.

It is an undisputed fact, the railroad bridge is the only structure upon the river that is an obstruction to our river.

Enclosed please find letters from some of our prominent citizens, giving their views. Should you wish further information, I shall be pleased to inform you to the best of my ability.

Very respectfully,

E. A. GROUT,
President Town Council.

GEORGE H. ELLIOT, Esq.,
Lieut. Col. of Engineers.

LETTER OF MR. GEORGE E. NEWELL.

PAWTUCKET, R. I., *August* 16, 1884.

DEAR SIR: In reply to your communication in relation to the railroad bridge over Pawtucket River, I find it is an obstruction to the free navigation of the river. The draw is narrow, and it purports to be 60 feet; it is practically but 45 feet, or nearly that. It is a serious obstruction to the passage of large vessels and barges. It should be widened and located differently. This draw is in the bend of the river, which makes it more difficult for vessels to get through. In my opinion, it should be placed further west, and have two openings of not less than 80 feet each in the clear.

Respectfully, yours,

GEO. E. NEWELL.

Mr. E. A. GROUT,
President of the Town Council, Town of Pawtucket, R. I.

LETTER OF MR. L. D. HORTON.

PAWTUCKET, R. I., *August* 15, 1884.

SIR: Your inquiry in regard to the obstruction to navigation of the Pawtucket River is at hand.

In answer would say that while the proposed removal of Washington bridge ameliorates the condition of navigation, a very serious and important obstruction will remain in the railroad bridge just below, on account of its position, causing a crooked passage-way, its width of draw rendering it impossible for craft to pass and repass, being obliged to turn while passing.

The only remedy is in constructing a draw of suitable width, 80 feet at least, in lieu of the present narrow one of 45 feet, further to the westward, thereby straightening the passage-way for vessels.

Yours, with respect,

L. D. HORTON.

E. A. GROUT,
President of Town Council, Pawtucket, R. I.

REPORT OF LIEUT. COL. WALTER MCFARLAND, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New Haven, Conn., January 14, 1885.

GENERAL: Under section 2 of the act of Congress relating to rivers and harbors, approved July 5, 1884, I have the honor to report as follows

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upon bridges and other works which interfere with free and safe navigation, all in the engineer district of which I have charge, extending from the headwaters of the Hudson River to the eastern end of Long Island sound.

Very respectfully, your obedient servant,

WALTER MCFARLAND,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT UPON BRIDGES, CAUSEWAYS, OR STRUCTURES WHICH INTERFERE WITH FREE AND SAFE NAVIGATION OCCURRING OR EXISTING IN THE ENGINEER DISTRICT EXTENDING FROM THE HEADWATERS OF THE HUDSON RIVER TO THE EASTERN END OF LONG ISLAND SOUND.

ENGINEER OFFICE, U. S. ARMY,
New Haven, Conn., December 31, 1884.

The only instances of this kind which have come under my notice in this district are those which occur in streams flowing into Long Island Sound.

Complaint has been made to me of the following bridges, namely: Those belonging to the New York, New Haven and Hartford Railroad Company, (1) at Cos Cob, Connecticut; (2) Bridgeport, Connecticut; (3) the Housatonic River, Connecticut; (4) New Haven on the Quinnipiac River, Connecticut; (5) Middletown, on the Connecticut River, Connecticut; (6) the city bridges at Bridgeport; (7, 8) the city and the Tomlinson bridge at New Haven, Connecticut.

The complaints against the railroad bridges crossing the Housatonic and Connecticut rivers, (3 and 5) are that the under-water part of the piers at the draws projects so far into the stream, and into what appears to be and ought to be a clearway, that the safety of vessels passing through the draw is endangered, and one or two vessels have already been seriously damaged by striking these hidden projections.

The remedy for this is the breaking off of these projecting parts and the placing of fender-piles to prevent passing vessels from coming in contact with the piers. Any projection of this sort, or any batter to the faces of the draw-piers, causes a sensible reduction in the width of the draw-span, making it less than it appears and is presumed to be, and probably less than the law under which it was constructed requires it to be.

The complaints against the railroad bridge and the city bridge at New Haven, (4 and 7,) crossing the Quinnipiac River, are that they are both without draws, and so prevent 6 miles of the Quinnipiac River which are navigable, and were formerly used, from being any longer used. The city bridge formerly existing there had a draw in it. The new one has not, nor has the railroad bridge- which crosses near it. It is evident that by these constructions the right of the property-owners above these bridges to the free navigation of this part of the Quinnipiac River has been violated. The remedy is to require the city of New Haven and the railroad company to put draws in these bridges, without which they are obstructions to the navigable waters of the United

States, according to the decisions of the Supreme Court of the United States.

The complaint against the Tomlinson bridge, (8,) which crosses the mouth of the Quinnipiac, is that its draw is narrow and dangerous from the strong current through it, produced by the contraction of the natural water-way from 1,400 to 310 feet, caused by the construction of a solid causeway 920 feet long, and five clumsy piers, taking up 170 feet more. The effect of all this is exceedingly bad, as it prevents the free inflow and outflow of the tides, and nearly destroys the usefulness of the Quinnipiac River above the bridge as a tidal basin. The obstruction to the passage of the water is so great that the bottom between the piers has been scoured to a depth of 18 feet, where the normal depth should be but 9 feet, and I have seen the water on one side of the causeway standing a foot higher than it was on the other side at the same time.

This bridge is owned by a bridge company, but is, I understand, now in the possession of or controlled by the New York, New Haven and Hartford Railroad. On account of the difficulty of the passage of the draw, boats are every now and then capsized there, in consequence of being thrown against the piers by the violent current. The bridge is in a dilapidated condition, and ought to be removed and replaced by a more modern construction, which would permit the free passage of the tides and which should be provided with a sufficient draw. It now constitutes an obstruction to a navigable channel of the United States, as defined in the decisions of the Supreme Court and in the act of Congress under which this report is being made. Its piers are three times as thick as they should be.

The complaints against the railroad bridges at Cos Cob (1) and Bridgeport (2) are that the draws are managed in such a way that they practically close the streams which they cross to navigation. I enclose a copy of the complaint received concerning the Bridgeport bridge, from which it appears that under the railroad regulations this bridge is kept closed about twelve hours out of the twenty-four, and about ten of these hours are between daylight and dark. The same complaint is made about the Cos Cob bridge.

Congress has repeatedly by law authorized the construction of draw-bridges over the navigable waters of the United States, so that a draw-bridge is not to be regarded in itself as an obstruction to navigation in a legal sense; but it is evident that although its construction may be authorized by law, yet it may be so managed after construction as to impede navigation unnecessarily, and thus become such an obstruction to the navigable water which it crosses as to demand its abatement. The traffic over the railroad to which this bridge belongs is very large, from sixty to seventy passenger-trains passing it every twenty-four hours, while the number of vessels which have to pass through the draw daily is quite small. It is plain that the larger interest cannot give way to the lesser one, and the only point that needs to be determined here, then, is whether the larger interest shows due respect to the lesser and does what it can to avoid obstructing it, or whether, secure in its power, this wealthy railroad corporation disregards its obligations towards it weaker competitor, a part of whose rights it has already taken away under the protection of the law and obstructs its operations.

Most of those engaged in navigation at Cos Cob and Bridgeport, whose vessels must pass these draws, are men of humble means, who must make their living out of these vessels, and who cannot defend themselves against a rich corporation like this if it chooses to oppress them, which it may readily do by omitting to take the means necessary for facilitating the passage of their vessels through the draw. The accompanying copy of the complaint from Bridgeport shows what difficulties are encountered by tows attempting to pass the draws there. The complaint makes no mention, however, of another source of trouble that is felt particularly at Cos Cob. Here there is so little water that unless a vessel goes through at a high tide she cannot go at all, and if when high tide occurs the bridge is closed, the vessel must often wait for the next high tide, and if this occurs after dark, she must wait again for the next one occurring in daylight or take the chance of grounding in the dark, and so it may be delayed twenty-four hours, and if the cargo consists of garden produce, as is often the case, intended for the New York market, it is often rendered unsalable by the delay, and the owner and carrier suffer the loss. This is, of course, no reason why the operation of a great line of travel should be obstructed or interfered with, but it is a very good reason why the corporation that manages it in their own interest should pay for the damage which the pursuit of their own interests causes to those who originally had a right to the free and unobstructed use of these waters.

The remedy for this difficulty is this: The draws should be of the most approved form, to be quickly opened and closed by steam-power. The regulations requiring them to be closed ten minutes before a train is due should be rescinded, and such signals should be established as would indicate to an approaching train, day or night, whether the draw is open or not, as is done on other railroads.

The vessels should have the prior right of passage, as trains would seldom be delayed by them, and when delayed the time lost would commonly be made up, while with the incessant passage of trains the vessels must be delayed hours, and may be delayed a day, time which they cannot make up, and which must prove a serious loss to men who are not able commonly to bear it.

In being permitted to construct bridges across navigable streams, railroad companies acquire valuable rights, which materially increase their revenues, while shippers suffer a corresponding loss. It is only fair that this loss should be borne by those who reap the benefit, which might be done by requiring the company to pay the owners of vessels at established rates for all delays caused by the non-opening of their draws when required, or by requiring them to keep tugs at hand to help these vessels through the draws. The real question here is whether the law will compel a rich and powerful corporation to deal fairly and justly with those who have already been by law compelled to surrender to it a part of their rights, ostensibly for the public good, but practically for the good of the corporation only.

The complaint against the city bridges at Bridgeport (6) is the same as that against the railroad bridge there. The only difference here is that the city corporation takes the place of the railroad corporation in the preceding case. It may be left to the city of Bridgeport to decide what is best for their city interests; but if for the good of their community they find it expedient to obstruct the navigable waters of the United States, they should pay for the damage that they do to those

who are entitled to the unobstructed use of those waters, and they should, moreover, provide every facility for passing vessels through the draws with as little delay as possible.

I submit herewith copies of the written complaints against the Bridgeport and New Haven city and railroad bridges, and the railroad bridge across the Connecticut at Middletown.

Respectfully submitted.

WALTER MCFARLAND,
Lieut. Col. of Engineers.

COMPLAINT AGAINST THE BRIDGE AT BRIDGEPORT, CONNECTICUT.

BRIDGEPORT, CONN., *August* 21, 1884.

SIR: In response to your circular asking for information concerning bridges, causeways, or structures that are an obstruction to navigation, we wish to write you in behalf of the Messrs. Beardsley, who do an extensive towing business in this vicinity.

On May 17, 1884, we wrote the Hon. Secretary of War upon this same subject. Whether this letter was referred to you or not we do not know, but take the liberty of giving several extracts from said letter, as the troubles and dangers complained of therein still exist and flourish in all their original vigor. "The common council of Bridgeport has passed an ordinance relative to draw-bridges * * * by which all the four draws are closed from 6.40 to 7 A. M., from 12 to 12.20 P. M., from 12.40 to 1 P. M., and from 6 to 6.20 P. M. Under the city's orders, the draws are closed one hour and twenty minutes during the busiest portions of the day, when boats wish to be placed at their docks to be unloaded. Between 12 and 1 o'clock the draws can be opened for the benefit of navigation only twenty minutes, and, inasmuch as a tow after passing through the first bridge could not reach the last before the twenty minutes of grace has expired, it is an actual obstruction for the whole hour.

"The New York and New Haven Railroad has also given to the draw-tender the following order, to wit, being number 49 of special instructions: 'No draw shall be opened within ten minutes of the time that a train is due, nor when a train is in sight or within hearing.' This draw-bridge is used both by the New York and New Haven Railroad and the Naugatuck Railroad, and about seventy trains cross it daily, so that the draw is closed by the railroad company eleven hours and forty minutes during the twenty-four hours of the day, which, with the time it is kept closed by the city, makes thirteen hours' time during which no tow nor boat can pass through the bridge. This is computed for the whole twenty-four hours, and most of the eleven hours left come in the night time, when the trains are much less frequent and when no towing is required.

"Between 6 o'clock in the morning and 6 in the afternoon fully fifty trains cross the bridge at short intervals, keeping the draw closed eight hours and twenty minutes, and, adding the time it is kept closed by the city, we find that it is closed nearly *ten hours out of the twelve*. Of course if a train is late, the draw is kept closed until it is past.

"The two hours left during which the draws may be opened is scattered through the twelve hours in such small portions that it is almost impossible to make a continuous trip. If there were but one draw, there would be but little trouble, as a tug with a tow could time its start so as to get through without having to wait; but after passing through one bridge, and having nearly reached the next, it may have become within ten minutes of the time when a train is due or the city's order may interpose, and the draw, after having been opened, is quickly shut and passage is barred. Then the trouble begins. The tug, of course, can stop and control itself, but a heavily-loaded schooner or barge acquires a momentum which makes it exceedingly difficult to stop it when the draw is suddenly closed against its passage. It is only by the most strenuous exertions that the tugs prevent their tows from either crashing into themselves or dashing into the bridges, and hardly a day passes without a narrow escape from a serious and perhaps fatal accident, the bow-sprits of sloops and schooners having several times nearly pierced the pilot-houses of the tugs, which have been unable either to get out of the way themselves or to stop their tows. But if they succeed in stopping the craft in tow without loss of life, limb, or property, they have to wait from ten minutes to half an hour for the draw to reopen. In the mean time they are drifting about in the narrow channel or get aground on the shallow mud flats, and by the time they get straightened out and get under headway again the chances are that either

the bridge they have been trying to get through, or at the best the next one, will be closed; so that in this way, independently of the danger incurred, it requires two or three hours to do what could otherwise be done in half an hour."

For the past week the draw of the bridge over the Housatonic River has been kept closed, to the great detriment of those engaged in the towing business, as well as consignees and ship-owners.

The bridge contractors keep the draw closed not because it cannot be opened, but because it is a little more convenient for them in the prosecution of their work.

There is also a very dangerous obstruction to navigation at the east pier of stone-work supporting the draw to the centre bridge. Messrs. Beardsley had heretofore, in going through the draw, injured and nearly sunk one boat loaded with coal, and roughly scraped several others, upon an unknown object.

They then employed Captain Scott, the diver, to examine the pier and see what caused the trouble. He went down in his diving armor, and found that the lower part of one of the corners projected out into the channel 2 *or* 3 *feet beyond the upper portion.* Evidently the brilliant genius who planned the work found that if the pier should be carried up as started it would encroach too far into the channel, so he merely dropped back with the upper part and left this sharp triangular projection to tear open the sides of any boats coming in contact with it. We understand that this corner is visible only at an unusually low tide, and, as no towing can be done then, its presence there was not suspected till the diver made his report. Any one going through would be justified in supposing he could run close to the pier, whereas he really cannot go within 3 feet of it without wrecking or injuring his boat. The city authorities have been notified of this obstruction, and have been requested to remove it, but although the diver says it can be easily and cheaply blown off, nothing has been done to remove it.

This projecting corner, and especially the trouble and delay experienced in getting through the draws, are a source of great vexation to both those who do the towing and consignees, who are delayed in getting their boats to their docks. Any relief that can be granted by the Government authorities will be duly appreciated.

Very respectfully, yours,

HOLLISTER & KELSEY,
Attorneys.

Col. WALTER MCFARLAND,
United States Engineer.

COMPLAINT AGAINST THE RAILROAD AND CITY BRIDGES AT NEW HAVEN, AND OTHER BRIDGES CROSSING THE QUINNIPIAC RIVER, CONNECTICUT.

NEW HAVEN, CONN., *August* 20, 1884.

DEAR SIR: Having noticed in the New Haven Evening Register of a recent date that you desire information, among other instances, as to whether any bridges, &c., now erected or in process of erection do or will interfere with free and safe navigation, and, if so, a report of the best mode of altering such bridges so as to prevent such obstructions, we desire to call your attention to the bridge crossing the Quinnipiac River at Grand street, to the New London Railroad bridge, located a few rods north of it, and to other bridges on said river, a mile or so still further north. Those structures form a total obstruction to navigation north of Grand street for sailing-vessels and steamers, and it is our opinion that they, or at least the first two mentioned, should be provided with suitable draws without delay. Quinnipiac is a navigable river for 6 miles or more north of Grand street. The Grand Street bridge was formerly a draw-bridge, and was used as such for many years, about half the vessels coming into the river passing through the draw, up to the time when it was closed. It was an unwieldy affair, and was closed by the town of New Haven about sixty years since, when it was understood that a good draw would be put in soon. Even since that time the town has persistently refused to construct a draw, although often requested to do so.

In 1851, when the New London Railroad Company were about to build their bridge, their president received written notice that steps were about to be taken for a draw in the Grand Street bridge, and that the people residing north of that point would expect and insist upon a draw in the railroad bridge; yet it was built without a draw, and up to this date the public have been deprived of the use of this arm of the sea, in defiance of the laws of the United States.

We respectfully request you, as a representative of the General Government, to give this matter a personal examination at your convenience, and make such report thereof as in your judgment may seem proper.

Should you desire any further information, a line addressed to J. H. Goodsell, 332 North Front street, New Haven, Conn., will receive prompt attention. Hoping the action you may be pleased to take will have a tendency towards the reopening of this public highway, we subscribe ourselves,

Very respectfully, yours,

JAMES H. GOODSELL.
S. CHIPMAN & CO.
J. E. BISHOP & CO.

Col. WALTER MCFARLAND,
United States Engineer.

COMPLAINT AGAINST THE BRIDGE ACROSS THE CONNECTICUT RIVER AT MIDDLETOWN, CONNECTICUT.

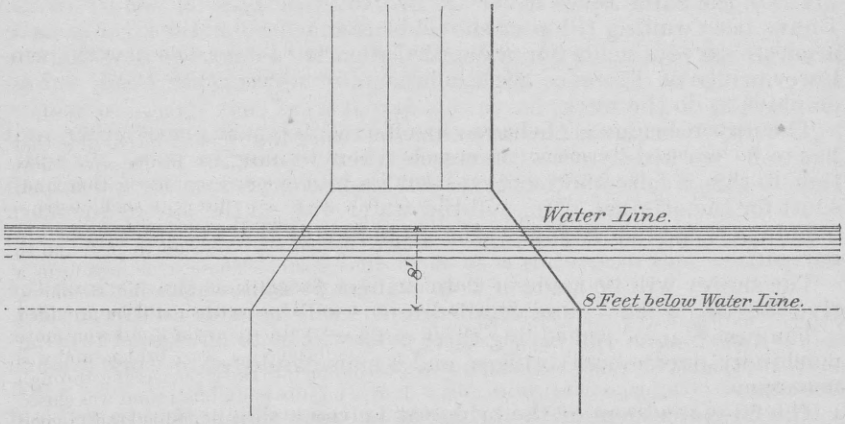
[Hartford and New York Transportation Company.]

E. H. WILLIAMS, President.
C. C. GOODRICH, Agent.

HARTFORD, CONN., *August* 13, 1884.

DEAR SIR: In accordance with your published card, I desire to have your engineers view the bridge-pier of the air-line bridge at Middletown, on Connecticut River. The unprotected abutments *below* the *line* of *low water* are such as to crush in the hull of a loaded vessel or barge before her guard-streaks can reach within 2 to 7 feet of the guard piling or pier itself. These points of contact are from 6 to 8 feet under water at low water. The schooner Rebecca, drawing 8½ feet, had whole bilge forward crushed, and sunk soon after, and is now on the ways at Gildersleeve's shipyard, at Portland, Conn., with over $1,000 damage bill. This schooner's rail was 3 feet clear of the pier or piling when she struck. The barge Grace Hills, loaded, was similarly sunk six years ago, with like bill.

The railroads claim that their draw-opening is the number of feet required by law, hence they are not obliged to protect these points, and navigation must look out and keep far enough away from the piers so as not to hit these sunken projections. I try to draw for you the shape of this dangerous work.



All the piers are more or less like this, and at none of them can you (with a loaded craft) get near enough to reach pier or piling abreast the piers without striking the rock foundation, while the vessel would apparently be still from 2 to 6 feet away from *possible harm.*

If you will examine here and at Lyme, and cause to be properly protected, you will earn the gratitude and good will of every vessel-owner on this river.

Yours, truly,

C. C. GOODRICH,
General Agent.

Col. WALTER MCFARLAND,
United States Engineer.

REPORT OF MR. WM. F. SMITH, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., January 19, 1885.

GENERAL: I have the honor to make the following report, as called for by section 2 of the river and harbor act approved July 5, 1884:

1. In the harbor of Wilmington are the remains of two wharves in front of the light-house lot, and under the control of the Light-House Board. These wharves are built on piles, and though not within the present channel, are yet an obstacle to the free passage of the flood-tides, and should be removed. I find that their removal had been determined upon by my predecessor in charge of this harbor, but as I have not been able to find any authority from the Light-House Board for their removal, it was not included in the project for the improvement of this harbor. The cost of removing them would be about $500.

In the same harbor, and on the other side of the Christiana River, about half a mile higher up, is a detached sunken pier, about 20 feet square, and below high-water mark. Like the light-house piers, this is not in the main channel, but is near enough to be dangerous at high water, and is an obstruction to the free passage of the tides, and should be removed. It was placed by private enterprise. The cost would be about $300. I enclose herewith a letter referring to this subject, received from the port-wardens of the harbor of Wilmington. Tracings* of both obstructions are also enclosed.

The draw-bridge situated at the foot of Third street is worked by hand, and so slowly as to impede navigation. The city should be compelled to put in machinery to work the draw by steam or other mechanical force.

2. On the Saint Jones River are two draw-bridges for county roads. I have been waiting till work should be commenced on the river to have accurate surveys made for a detailed report. I can state now that the lower bridge at Florence has machinery for working by hand, but no employé to do the work.

The upper bridge at Lebanon has its turning-gear out of order, and has to be worked by crews of vessels when desiring to pass. In addition to this, a false abutment was put in, to compensate for a draw too short for the original plan, and the water-way on the site of the main opening is thus narrowed, to the prejudice of the free passage of the current.

The survey will be made of both bridges as soon as the work on the river begins, when a more detailed report will be made on this subject.

The best plan of remedying these evils will be to have good turning-machinery put in both bridges, and a man employed to work it when necessary.

The false abutment of the bridge at Lebanon should be removed and the draw lengthened to reach to the abutment originally intended for it.

It should be the duty of the State of Delaware to compel the making of these improvements.

I am not at present aware of any other structures erected or in process of erection which "do or will interfere with the free and safe navigation" of any of the navigable waters in this district.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

To the CHIEF OF ENGINEERS, U. S. A.

*Tracings omitted.

LETTER OF THE BOARD OF PORT-WARDENS OF THE HARBOR OF WILMINGTON, DELAWARE.

[Board of port-wardens, city of Wilmington, Del.]

NOVEMBER 28, 1884.

DEAR SIR: I was directed by the Board of Port-wardens, at a meeting held November 26, 1884, to communicate with you stating that the sunken pier in the Christiana River, in the line passing through harbor line stones 5 and C 7, is regarded by the Board as a very dangerous obstruction to navigation, and that it will be very gratifying to the Board if it please you to incorporate in your report to the Secretary of War such mention of this matter as may result in the removal of the pier by the United States Government.

Yours, &c.,

FREDERIC H. ROBINSON,
Secretary.

Gen. WM. F. SMITH.

REPORTS OF MAJOR PETER C. HAINS, CORPS OF ENGINEERS.

(1) LONG BRIDGE ACROSS POTOMAC RIVER.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., September 10, 1884.

SIR: In compliance with General Order No. 13, Headquarters Corps of Engineers, July 23, 1884, I have to report, for the information of the Secretary of War, that the structure known as "Long Bridge," spanning the Potomac River from Washington, D. C., to Alexander's Island, Virginia, was first built by the Washington Bridge Company, under an act of incorporation provided by act of Congress approved February 5, 1808, entitled "An act authorizing the erection of a bridge on the Potomac River within the District of Columbia."

In 1834 the Government of the United States purchased the rights of the Washington Bridge Company and the remains of the original structure, which had been partly destroyed in 1831 by a freshet. It was afterwards rebuilt by the Government and maintained by it until June 21, 1870, when by act of Congress, the Baltimore and Potomac Railroad Company was authorized to take possession under certain conditions.

It has remained in the custody of said railroad company since that time, and is used and occupied by it as a railway bridge, and by the public as a wagon and foot bridge.

It interferes now with the free and safe navigation of the Potomac River, and will do so in a greater degree when the improvements now in progress on the river front approach more nearly completion. The draw of this bridge is only 70 feet wide, and, consequently, in times of freshets or high winds, does not afford a free and safe opening for large vessels. Besides, it is never opened at night at all, so that the bridge constitutes a complete barrier to all navigation through it after dark. The bridge, however, will become a serious obstruction as the work of improving the river front advances. Congress has already appropriated $900,000 for the improvement of the Potomac River in the vicinity of Washington, having reference to the improvement of navigation, the establishment of harbor-lines, and the raising of the river flats. A part of this money has already been spent, and the work is now well under way. The necessity of rebuilding Long bridge is referred to by

the Board of Engineers in its report of February 18, 1882. The report includes among its recommendations that—

> The Long bridge shall be rebuilt at an early period, during the progress of the improvements, with wide spans upon piers offering the least possible obstruction to the flow of water.

Other engineers have at various times called attention to the necessity of a new bridge. The location of the present bridge is faulty, its construction more so. Above the bridge the channel of the river curves well over to the Virginia shore, so that at the site of the bridge the channel current, in the ordinary stages of the river, sets towards the Washington side, making, with the axis of the bridge, an obtuse angle. The piers are set parallel, or nearly so, with the current in such stages. In times of freshets, however, the direction of the current is more direct, the water takes a shorter cut across the shoals to reach its proper level. The piers of the bridge being located to best suit the low stage of the river, they stand obliquely to the current in times of freshet, making the obstruction greatest when it should be least. The bridge thus acts as a partial dam in times of freshets, checking the flow of water above and causing the deposition of the material that is rolled along the bottom or held in suspension.

The spans of the bridge are too narrow, requiring a greater number of piers than would otherwise be needed, consequently the flow of water is proportionately obstructed. While the number of piers is unnecessarily great, and their direction with reference to the freshet current objectionable, a still more formidable objection exists in the construction of the piers themselves. They are built of stone on a pile and grillage foundation, and to the ordinary observer would appear unobjectionable except in respect to number, height, and location with reference to the freshet current. The pile and grillage, however, reaches to about the level of low water, and is not ordinarily seen, but, in order to make the foundation secure, a large quantity of riprap stone has been deposited around each pier, so that while each pier seems to be narrow, it practically spreads out like a cone beneath the surface of the water.

The bottom chord of each span is too low, being only 10.7 feet above low water. The adjacent flats are to be filled to a height of 3 feet above the freshet slope of 1877, which will make them at the site of the bridge about 12 feet above low water. The bottom chord of the bridge is, therefore, only a little more than 1½ feet above the level of the freshet slope of 1877, and nearly 1½ feet below the proposed grades of the flats when they are reclaimed from overflow.

The effects of logs, trees, &c., swept down the river and against the bridge in such a freshet can readily be imagined. It was practically destroyed in 1831 by such a freshet.

The improvements now in progress contemplate the closing of the Washington channel at the site of Long bridge; hence, all the water that now finds its way down the river by that route will be forced into the Virginia channel. The capacity of the latter must, therefore, be increased. This is now being done above the bridge, and it will be done below it, by dredging. To secure the required area of cross-section through the bridge would require dredging to be done between the piers, which, it is believed, is not practicable to the extent required without endangering the structure.

The best and only satisfactory way of correcting the defects of this bridge is to build a new one several feet higher, on fewer piers, with wider spans. The piers should be set as nearly as practicable in the axis of the freshet current, and should rest on the rock or hard-pan, which it is believed will be found to underlie the softer strata of mud. In any case, the body of each pier should extend to a depth below the surface of the water equal to the ruling depth of water above and below the bridge.

No riprap protection should be allowed around the piers to reach a level above that of the general bottom of the river channel in the neighborhood of the bridge.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

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(2) POTOMAC AQUEDUCT.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., November 5, 1884.

SIR: In accordance with General Order No. 13, current series, Headquarters Corps of Engineers, United States Army, I have to report that the bridge known as the "Aqueduct," that spans the Potomac River between Georgetown, D. C., and the Virginia shore, is an obstacle to the free and safe navigation of the Potomac River.

The bridge is an aqueduct for the Washington and Alexandria Canal, which is here carried across the Potomac River.

The piers of the bridge are built of stone, the superstructure being of wood. There is ample width between the piers for the largest vessels that come to Georgetown to pass, and the depth of water is over 20 feet at low tide.

At mean high tide there is only a clear space of 25 feet between the timber supports of the lower chords of the truss and the surface of the water. As a consequence, none but the smallest of steamboats can pass under it, and practically it renders navigation above the bridge impracticable for anything but small tugs and flat-boats.

Paragraph 2550, Revised Statutes, provides that the collection district of Georgetown shall extend to the head of the navigable waters of the Potomac River, which is near Little Falls. Between the latter place and the Aqueduct bridge, a distance of more than 3 miles, there exists a deep, navigable channel, obstructed only at two places by shoals, which have over them a depth of 16 and 19 feet, respectively, at mean high tide. On the Georgetown side of the river there is over 19 feet at high tide for a distance of 3,000 feet above the bridge.

In a commercial point of view, that part of the river would be of great value if the way to it was not barred by this bridge.

It is an obstruction in another respect. The piers, abutments, and causeway reduce the width of the river from about 1,600 feet, its natural width between the lines of high water, to about 950 feet. This reduction causes an abnormal rise in the surface of the water in times of freshets.

The bridge can best be altered so as not to interfere with the free and safe navigation of the river by discontinuing its use as an aqueduct, and providing a draw through which vessels can pass. This would necessitate the entire rebuilding of the superstructure, and the modification of one of the abutment piers to serve as a draw-pier.

Other interests may be involved in such a change, but a discussion of them is beyond the province of this report. The bridge interferes with the free and safe navigation of what would doubtless become a very important part of the river were it not there, and the only satisfactory way of removing this interference is to dispense with the aqueduct portion and rebuild the superstructure as a highway bridge, with a suitable draw for the accommodation of vessels of the largest class that visit Georgetown.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., October 31, 1884.

GENERAL: In accordance with General Order No. 13, Headquarters Corps of Engineers, United States Army, current series, relative to sections 2 and 8 of the act of July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, I have the honor to submit the following final report on all the matters known to me in this district covered by the foregoing:

The following bridges are considered obstructions to the free navigation of the waters that they cross, for the reasons specified below, viz:

The Norfolk and Western Railroad bridges over the Eastern and Southern branches of the Elizabeth River (shown on the accompaning map*) and the wagon bridge over Town Creek, North Carolina, 3½ *miles above* its mouth. Each will now be referred to in detail.

(1) *The Norfolk and Western Railroad bridge over the Eastern branch of the Elizabeth River.*—The present draw-opening is at the extreme northern end of the bridge at the right bank. It is 40 feet in the clear, and has a depth through it of 13 feet at mean low water. The approaches to this draw are as follows: The upper approach is very crooked and shallow from the main channel to the draw-opening. On a line perpendicular to the draw-opening, and about 300 feet above it, is a shoal with but 1½ feet of water on it at mean low tide. The lower approach has been lately dredged by the United States, and, so far as depth is concerned, is satisfactory. The draw-opening should be at least 50 feet wide, and placed near the middle of the stream, where the deep channel is, between the piers marked "A" and "B," with suitable guide-piles above and below for safety of navigation through it.

(2) *The Norfolk and Western Railroad bridge over the Southern branch of the Elizabeth River.*—The river at this point has been contracted by earthen causeways, terminating in masonry bridge abutments on either

*Map omitted.

side, that on the east side being 88 feet long, and that on the west side 256 feet in length. The present draw-opening is at the extreme eastern end of the bridge, is 40 feet in the clear, and has a depth through it of 8 feet at mean low water. The approaches to this draw are on a curve, and hard for vessels, particularly those with tows, to make, especially when the wind blows from certain quarters.

I quote as follows, relative to this bridge, from report dated January 30, 1872, of the late Capt. C. B. Phillips, Corps of Engineers, found in report of the Chief of Engineers, 1872, page 719:

* * * * * * *

Below the lock of the Dismal Swamp Canal no difficulty is experienced in the navigation of the Elizabeth River. A deep and unobstructed channel exists up to this point and, in fact, to a point about 2 miles further up the river.

The above remark should be qualified by stating that the Norfolk and Petersburg Railroad bridge which crosses the river about three-fourths of a mile above the Dismal Swamp lock, causes considerable annoyance to shipping, much of which is taken up and down the river in long tows. As many as five schooners sometimes constitute a single tow.

The draw of the bridge referred to is badly located. It is nearly over to the right bank of the river, away from the deepest water, and out of the course which shipping would take were it not for the bridge. This evil, however, it appears must continue to exist, as litigation has, I understand, failed to correct the matter.

* * * * * * *

("The Norfolk and Petersburg Railroad" is now a part of the Norfolk and Western Railroad.)

The draw-opening should be at least 60 feet wide, and placed near the middle of the stream, where the deep channel is, between the piers marked C and D, with suitable guide-piles above and below, for safety of navigation through it.

(3) *Bridge over Town Creek North Carolina.*—I quote as follows regarding this bridge, from report dated August 4, 1884, of the late Mr. W. H. James, assistant engineer:

* * * * * * *

Town creek, North Carolina, for the improvement of which $1,000 was appropriated by act approved July 6, 1881, and expended under my charge, for an account of which work reference is respectfully made to Appendix K, 17, of the Annual Report of the Chief of Engineers for 1883, is obstructed 3½ miles above its mouth, on the west side of the Cape Fear River, 8 miles below Wilmington, by a common county-road bridge, belonging to the county of Brunswick, North Carolina. This bridge has no draw. The creek is navigable for the improved distance of 19 miles from its mouth, for small steam-launches drawing not over 3½ feet of water. These boats, in passing under the bridge, have to lower their smoke-stacks, and, for want of a draw, none but very small, low boats can pass at all. I am informed that if compelled to put in a draw or abandon the bridge, the county would probably remove it and close the road.

It is manifest that there should be either a proper draw-opening in this bridge or else it should be removed.

It is believed that the southern abutment or causeway (shown on accompanying map*) to the county bridge that formerly crossed the eastern branch of the Elizabeth River interferes with the free and safe navigation of said river to the extent described below, for which reasons the structure should be removed.

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*Map omitted.

In my communication to you of the 1st ultimo, relative to Norfolk Harbor, I stated as follows in regard to this:

* * * * * * *

It is thought that the shoaling at the mouth of Eastern Branch is very largely due to natural causes that will always exist, aided heretofore by the county bridge, a part of which has been removed, as stated, leaving the southern abutment, *which should also be removed.* There are no means of ascertaining the amount of deterioration due specifically to this bridge.

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I also quoted in said communication from reports as follows:

1. Report dated January 30, 1872, of the late Capt. C. B. Phillips, Corps of Engineers, (Report of the Chief of Engineers 1872, page 722.)

* * * * * * *

We find slight and rather peculiar changes in the bed of the harbor between the county bridge across the Eastern Branch and the confluence of the two branches. We find a slight tendency of the channel to deepen immediately and for some little distance below the bridge.

Further down (some 800 yards below the bridge) shoaler water, which, as far as is known, has always existed, is encountered, and continues until the influence of the Southern Branch is felt. The depth of the shoaler water referred to has changed but little since the soundings were taken by the Coast Survey. It appears to have filled in very slightly. Its worst feature seems to be that the shoal is slowly extending along to the wharves immediately below the ferry. I attribute these changes to the existence of the county bridge across the Eastern Branch. The stream is considerably contracted at this point by a long causeway, which constitutes the southern extremity of the bridge.

This accounts, in my opinion, for the slight deepening immediately below the bridge, and also for the slight additional shoaling below, the removed material being deposited as soon as the wider portion of the stream is reached.

It will be perceived that a considerable deepening has taken place immediately at the confluence of the two branches. This would seem to be but the mere result of the changes just referred to, the gradual extension of the shoaler water near the ferry seeming to contract the width of the southern branch channel, and causing it to make deeper water. From this point on towards the entrance of the harbor, and also in following up the course of the Southern Branch, the water in the channel seems to have pretty generally maintained its original depth.

* * * * * * *

2. Report dated February 15, 1875, of Mr. S. T. Abert, U. S. civil engineer, (Report of the Chief of Engineers, 1875, part 2, pages 146–147.)

* * * * * * *

The bar which occupies the main channel is partly due to the county bridge, 800 yards above.

* * * * * * *

This bridge is owned by private parties, who, I have been informed, are willing to sell it, and the city authorities have taken the preliminary steps for its purchase and removal. In order to benefit the harbor to the fullest extent, the causeway should be removed at the same time as the bridge.

* * * * * * *

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., January 15, 1885.

SIR: In accordance with the instructions of General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington,

D. C., 23d July, 1884, I have to submit, herewith enclosed, my final report upon the * * * bridges, &c., referred to in sections 2 and 8 of the river and harbor act of July 5, 1884.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

FINAL REPORT UNDER SECTIONS 2 AND 8 OF THE ACT OF JULY 5, 1884, MAKING APPROPRIATION FOR THE CONSTRUCTION, REPAIR, AND PRESERVATION OF CERTAIN PUBLIC WORKS ON RIVERS AND HARBORS, AND FOR OTHER PURPOSES.

* * * * * * *

NEUSE RIVER, NORTH CAROLINA, (UNDER IMPROVEMENT.)

Near Kinston this river is crossed by the Atlantic and North Carolina Railroad on a draw-bridge, whose draw-span is placed upon the shallow side of the river, instead of over the main-channel way. The present improvement will probably be so far finished in 1886 as to permit of a deeper navigation above this bridge at Kinston than will then be able to pass through this draw-opening. All the steamer captains whom I have so far heard from, state that they have not as yet been delayed from want of water at this draw-opening, and I do not see any reason for a change in the position of a draw before 1886. I therefore recommend that this draw may be permitted to remain in its present position for the present, but that it be moved to the channel side of the river as soon as it becomes the chief serious obstruction to a permanently increased depth of navigation between New Berne and Kinston.

Near Goldsboro' this river is crossed by the Wilmington and Weldon Railroad, on a single-span bridge, without a draw. The bottom of the bridge is about 17 feet above low water. The channel is said to be partially obstructed by a pier of the former bridge. Very few steamers have so far reached this bridge, although the river is navigable for several miles above Goldsboro'. I therefore recommend that this bridge be permitted, for the present, to remain in its present condition, provided that the owners will clear away the obstructing portion of the old pier beneath.

Above Goldsboro', and below Smithfield, there are six county bridges, without draws, but there has as yet been no navigation demanding draws. When needed, the draws will undoubtedly be put in by the county authorities. I therefore recommend that these bridges be permitted for the present to remain in their present condition, provided that their owners will insert draws therein whenever needed by the steamers.

As far as I know, these eight are the only bridges below the head of present navigation which obstruct the navigation of the Neuse River.

TRENT RIVER, NORTH CAROLINA, (UNDER IMPROVEMENT.)

As far as I know, there are no bridges below Trenton, the head of present navigation, that obstruct the navigation of the Trent River.

CONTENTNIA CREEK, NORTH CAROLINA, (UNDER IMPROVEMENT.)

Between Stantonsburg, the head of present improvement, and Snow Hill, the head of present navigation, there are three county bridges, without draws, but there has as yet been no navigation demanding draws. When needed, the draws will undoubtedly be put in by the county authorities. I therefore recommend that these bridges be permitted, for the present, to remain in their present condition, provided that their owners will insert suitable draws therein whenever needed by steamers.

Between Snow Hill, the head of present navigation, and the mouth of the river there are no bridges, as far as I know, that obstruct the navigation of the Contentnia Creek.

NEW RIVER, NORTH CAROLINA, (UNDER IMPROVEMENT.)

As far as I know, there are no bridges below the head of present navigation that obstruct the navigation of the New River.

CAPE FEAR RIVER, NORTH CAROLINA, (UNDER IMPROVEMENT.)

As far as I know, there are no bridges below Fayetteville, the present head of navigation, that obstruct navigation.

* * * * * * *

TOWN CREEK, NORTH CAROLINA, (TRIBUTARY OF THE CAPE FEAR RIVER, IMPROVED IN 1882–'83.)

Three miles above its mouth, this river is reported to be crossed by a county bridge, without a draw, thus obstructing an otherwise 5-foot navigation over nearly 19 miles of river. I therefore recommend that the owners of this bridge be required to insert therein a draw-span of 40 feet clear width.

One mile below the present head of navigation is a second bridge, without draw, but not regarded at present as obstructing the present navigation. I therefore recommend that it be permitted, for the present, to remain in its present condition.

Between the head of present navigation and the mouth of the river, these two bridges are, as far as I know, the only ones that obstruct the navigation of Town Creek.

LILLINGTON RIVER, OR LONG CREEK, NORTH CAROLINA, (TRIBUTARY OF THE CAPE FEAR RIVER, IMPROVED IN 1882–'83.)

As far as I know, there are no bridges below the head of present navigation that obstruct the navigation of the Lillington River.

BLACK RIVER, NORTH CAROLINA, (UNDER SURVEY.)

As far as I know, there are no bridges below Point Caswell, the head of present useful navigation, that obstruct the navigation of the Black River.

NORTH EAST CAPE FEAR RIVER, NORTH CAROLINA, (UNDER EXAMINATION.)

One mile above Wilmington, this river is crossed by the Wilmington, Columbia, and Augusta Railroad, on a through bridge, provided with a suitable draw-span.

The free passage of boats on the river side of the draw-pier is rendered extremely difficult by strong cross-currents, by shoals above the bridge, and by the oblique position of the pier; while the free passage on the shore side of the draw-pier is rendered difficult by the absence of suitable fenders next to the shore, and by the presence of an old submerged bridge pier near the river bank, about 100 yards below the present bridge. This old sunken pier is said to have occupied its present hidden position for over thirty years, and is manifestly an obstruction to the free use of the railroad-draw opening. Its removal would cost, perhaps, $200, but under the circumstances I do not think the present bridge's owner should be held responsible for the old pier's non-removal. I recommend that this old sunken pier be removed at the expense of the United States, and that the owners of the railroad bridge be required to provide suitable fenders for 100 feet above and below the bridge, on the shore side of the draw-opening.

Eighteen miles above Wilmington, this river is crossed by the Wilmington and Weldon railroad, on a pier-bridge, without a draw span. The bottom of the bridge is only about 10 feet above high-water mark, and seriously obstructs an otherwise clear 6-foot navigation over 60 miles of river. I therefore recommend that the owners of this bridge be required to provide it with a suitable draw, of span from 40 to 60 feet width.

Higher up, the river is crossed, at Kroom's, at Deep Bottom, and at Chinquepin, by county bridges, without draws, but up to present at these places there has not been any steam-navigation demanding draws. I therefore recommend that these bridges be permitted, for the present, to remain in their present condition, provided that their owners will insert suitable draws therein whenever needed by steamers.

As far as I know, these five bridges are the only ones obstructing the free navigation of the North East Cape Fear River from its mouth up to Hallsville, the head of present navigation.

WACCEMAW RIVER, SOUTH CAROLINA, (UNDER IMPROVEMENT.)

As far as I know, there are no bridges below Conwayboro', the present head of useful navigation, that obstruct the navigation of the Waccemaw River.

GREAT PEDEE RIVER, SOUTH CAROLINA, (UNDER IMPROVEMENT.)

About 125 miles above Georgetown, this river is crossed by the Wilmington, Columbia, and Augusta Railroad, on a bridge provided with a draw-span of suitable width. Projecting iron-work on the piers, swift cross-currents in the river, an improperly arranged piling-fender, combine to subject passing vessels to injury. Several miles above the railroad bridge, the river is also crossed by the toll-bridge of the Society Hill Bridge Company, on a through bridge provided with a draw-span of proper width. Swift and strong cross-currents and the absence of suitable fenders combine to subject passing vessels to injury by the bridge-piers. I recommend that the owners of both these bridges be

required to provide strong and suitable fenders at both ends of these draw-openings, these fenders extending 100 feet above and below the bridge, and rising above ordinary high water to within about a foot of the draw-span's lower chord.

As far as I know, these two bridges are the only ones that obstruct the navigation of the Great Pedee River.

SANTEE RIVER, SOUTH CAROLINA, (UNDER IMPROVEMENT.)

The canal at present being cut through Mosquito Creek, to serve as the outlet of Santee River to Winyaw Bay, is crossed near Winyaw Bay by a county free bridge, without a draw. This bridge, capable of obstructing the future navigation of the canal, is to be replaced by a draw-bridge, at the expense of the United States, in accordance with the approved projects of 1881, 1882, and 1884. (See letter from office of Chief of Engineers, United States Army, dated 25th September, 1884.)

About 100 miles above its mouth this river is crossed by the North Eastern railroad, on a bridge provided with a suitable draw-span; but the projecting iron-work of the bridge-piers, combined with cross-currents in the river, are apt to injure passing steamers. I recommend that the openings be provided with suitable fenders on both ends of the span, these fenders to extend about 75 feet above and about 75 feet below the bridge, and to rise above ordinary high water to within about a foot of the draw-span's bottom chord.

As far as I know, these two bridges are the only ones obstructing the navigation of the Santee River.

WATEREE RIVER, SOUTH CAROLINA, (UNDER IMPROVEMENT.)

Eight miles above its mouth, in the Santee, this river is crossed by the Camden Branch of the South Carolina Railroad, on a wooden-deck bridge, without a draw-span, the bottom of the bridge being 15.3 feet above low water. The use of this bridge *without a draw* has been specially authorized, *as far as concerns the State of South Carolina*, by State acts passed in 1853 and 1858.

Thirteen miles above its mouth, the river is also crossed by the Wilmington, Columbia, and Augusta Railroad, on a wooden-deck bridge, without a draw-span, the bottom of the bridge being about 17 feet above low water.

As far as I know, these two are the only bridges obstructing the navigation of the Wateree river.

The present improvement will probably be finished next year sufficiently to allow of a tolerably clear 4-foot navigation to steamers of 52 feet width over the whole river from its mouth up to Camden. The current of this river is swift and strong, especially during high-water stages. Both bridges have already proved serious obstructions to a desired navigation.

I therefore recommend that the owners of both of these bridges be required to insert suitable draw-spans in their bridges; that the spans be at least 60 feet wide in the clear; that the openings be placed with reference to the deep water and the convenience of navigation; that the openings be provided with strong and suitable fenders on both ends of the span, extending, say, 150 feet above and 80 feet below the bridge; and that these fenders should rise above ordinary high water to within about a foot of the draw-span's lower chord.

CONGAREE RIVER, SOUTH CAROLINA, (UNDER SURVEY.)

At the city of Columbia this river is crossed by a carriage bridge, whose bottom is 36 feet above low water, and whose spans are at least 100 feet in length. Two miles below the city the river is also crossed by the Charlotte, Columbia, and Augusta Railroad, on an iron-deck bridge, whose lowest portions are about 40 feet above low water, and whose spans are at least 100 feet in length. Neither of these two bridges are provided with draw-openings, but the rapids in the river at this point will probably always compel passing boats to follow a canal near the shore end of the bridges. Passing steamers will probably be few in number, and might justly be forced to make use of hinged smoke-stacks.

* * * * * * *

Five miles above the mouth of this river, it is crossed by the South Carolina Railroad, on a deck bridge, provided with a draw of 53.5 feet clear width. This draw-span is for the present built solidly into the bridge; but is ready to be suitably mounted upon its revolving platform as soon as demanded by the interests of navigation. If the now-contemplated improvement of the river be carried out, this draw should be ready for actual use in 1886. The current of this river at this point is swift and strong, especially at high stages of water. I therefore recommend that this bridge be permitted to remain for the present in its present condition, provided that when navigation is opened, the bridge-owners will suitably finish the mounting of its present draw-span, and that the openings be provided with strong and suitable fenders on both ends of this span extending, say, 75 feet above and below the bridge, and rising above high water to within about a foot of the draw-span's bottom chord.

As far as I know, these three bridges are the only ones that obstruct the navigation of the Congaree river.

W. H. BIXBY,
Captain of Engineers.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., January 19, 1885.

GENERAL: In compliance with the provisions of the second and third clauses of section 2 of the last river and harbor act, promulgated in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to report as follows:

First. The Charleston and Savannah Railroad Company is now replacing a wooden bridge over the Ashley River, about 12 miles above the city of Charleston, by an iron structure. It is to be a draw-bridge, and the draw-span is believed to be ample. It is not known by what authority, if any, the wooden bridge was constructed. It is about twelve years old.

Second. A highway bridge over the Ashley River at Charleston is contemplated. It is understood that its construction will be commenced very soon. Under what authority, if any, is not known to me.

Third. A small wooden bridge at Toby's Bluff, on the Salkehatchie River, is said to interfere in some degree with raft navigation. This is a small matter, but additional information will be collected.

Fourth. The Charleston and Savannah Railroad bridge, over the Salkehatchie River has no draw-span; neither has the highway bridge, about one-quarter of a mile below it, over the same stream. These bridges offer no obstruction to raft navigation, and there is no present necessity for a draw in either bridge.

* * * * * * *

Sixth. The Savannah, Florida, and Western Railroad bridge, over the Altamaha River at Doctor Town, Ga., has no draw. The small steamers plying on this river are built with low pilot-houses, and have hinged chimneys, thus enabling them to pass under the bridge.

To pass up this river requires, in the United States snag-boat Toccoa, the removal of mast and smoke-stack, thus causing a delay at the bridge of about one day. I regard this bridge as an obstruction to the navigation of the stream, which obstruction will become greater as the navigation improves.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Brevet Major General, U. S. A.

General JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OEFICE,
Mobile, Ala., July 29, 1884.

SIR: In compliance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, calling "attention to sections 2 and 8 of act approved July 5, 1884, making appropriations for the construction, repair, and preservation of certain rivers and harbors, and for other purposes," I have the honor to report that two railroad bridges now erected and crossing the Cahaba River, Alabama, interfere with the free and safe navigation of said stream and with the improvement which has been carried on, and, if not altered, will render the prospective improvement of said river of but little or no value to commerce and navigation.

Selma and New Orleans Railroad bridge, crossing the Cahaba River about 8 miles above its mouth, consists of two spans, (Howe truss,) resting on wooden piles or piers in the centre of the river, the shore ends resting on brick piers or abutments on the bank above low water. The foot of the centre pier is protected from drift and scour by a sheet-pile coffer-dam. This coffer-dam occupies 28 feet of the river, in a width of 141 feet of water surface at low water. The bridge crosses the river at an angle of about 20 degrees to its flow, and is situated in the center of a long curve or bend; the bottom chord of the bridge is 42.8 feet above the level of low water, May 18, 1883. This bridge is a fixed structure, and is not supplied with any draw-opening, booms, dikes, piers, or other suitable and proper structures for the guidance of any

steamboat, raft, or other water craft past it. A depth of 6 to 7 feet of water was found under the bridge at low water, May 18, 1883. This bridge is owned by the Selma and New Orleans Railroad Company; is used by them and the Cincinnati, Selma, and Mobile Railroad in making their connections between the east and west banks of the Cahaba River.

Alabama Central Railroad bridge, crossing the Cahaba River about 21 miles above its mouth, consists of one long and one short span. The long span is covered in, both being supported by a brick pier, standing out in the river, the centre of pier being 30 feet from the east bank. The shore end of the short span is supported on the east bank by iron columns, the shore end of long span resting on a brick pier or abutment standing on the west bank about 14 feet from water's edge at low water. The pier in the river is protected from drift and scour by a sheet-piling coffer-dam, which, with the pier, occupies 20 feet of the river in a width of 135.5 feet of water surface at low water. The bridge crosses the stream at right angles to its flow, and is situated in the centre of a short but easy bend; the bottom chord of the bridge is 40.7 feet above the level of low water, May 17, 1883. This bridge is a fixed structure, and is not provided with any draw-openings, booms, dikes, piers, or other suitable and proper structures for the guidance of any steamboat, raft, or other water craft past it. A depth of 4 to 7 feet of water was found under the bridge at low water, May 17, 1883. This bridge was built by the Alabama Central Railroad Company, and is used and operated by the East Tennessee, Virginia, and Georgia Railroad Company in making their connections between the east and west sides of the Cahaba River.

The enclosed tracing * shows the location and elevation of both bridges from an examination made May 17 and May 18, 1883.

Both of these bridges being fixed structures, (with an elevation of 40.7 feet, Alabama Central Railroad, and 42.8 feet, Selma, and New Orleans Railroad, above low water, of May 17 and 18, 1883,) with an increase in the height of the river during freshets of from 35 to 37 feet, it is apparent that both bridges are impassable during the period of its continuance. They are also impassable (except for low flat-boats) during a stage of water from 15 to 18 feet above low water, at which medium stage the river remains for some time during the winter months, and at which particular time the river is in good boating order, and the products of the country lying above the bridges are seeking a market.

The only remedy that can be furnished by the above-named companies in regard to the bridges, so as to prevent them from being a further obstruction to navigation, is to take them down and rebuild them, by placing the supporting piers in such a manner as to leave a draw-opening of at least 100 feet over the best portion of the river, and the new bridges to be supplied with suitable and proper structures for the guidance of vessels safely through them.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

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* Tracing omitted.

REPORT OF CAPTAIN R. L. HOXIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., October 26, 1885.

SIR: In compliance with General Orders No. 13, Headquarters Corps of Engineers, United States Army, July 23, 1884, inviting attention to sections 2 and 8 of the river and harbor act approved July 5, 1884, and requiring report thereon, I have the honor to submit the following:

COOSA RIVER, GEORGIA AND ALABAMA.

The East and West Railroad bridge crosses the Coosa River one mile below lock 3. It is an obstruction to navigation, being of insufficient height for boats to pass under it, and having no draw. Certain modifications have been proposed by the railroad company to adapt it to the requirements of navigation. These modifications consist in the rebuilding of one pier on the east side of the existing channel, which has been cut through the rock, so as to make it the pivot-pier, and the substitution of a wrought-iron draw-span for the adjacent spans of the present structure. It will give an opening of 84 feet width over the existing channel, and another of the same width on the east side of the pivot-pier, available for another channel, should it be found necessary to cut it through the rock bed of the river. I am of opinion that the proposed modification of this bridge will meet the present and prospective requirements of navigation on the Coosa River. Since the transmission of former reports upon this bridge, the modifications mentioned in the foregoing have been commenced, and are now being made by the railroad company.

OCMULGEE RIVER, GEORGIA.

Near Lumber City, Ga., the East Tennessee, Virginia, and Georgia Railroad crosses the Ocmulgee River on a bridge having a draw-span, of which but one opening is available for navigation, and this has a width at low water of 40 feet, with good approaches above and below. In time of freshets, cross-currents in this channel render caution necessary in passing it. No complaint is made by steamboat-men, but whenever the bridge is rebuilt or extensively repaired, the pivot-pier should be shifted in position so as to give a clear span of 75 feet over the best portion of the river channel. About one-half mile above Hawkinsville the same railroad crosses the Ocmulgee River, on a wooden Howe truss bridge, about 25 feet above low water, and without a draw. This bridge will be an obstruction to navigation, as the improvement of the river is in contemplation as high up as Macon, Ga. The remedy is the introduction of a draw-span, with not less than 60 feet clear opening. About 6 miles below Macon the same railroad again crosses the Ocumlgee River, on a wooden Howe truss bridge, reported to be about 15 feet above low water. This will prove an obstruction to navigation when the river is improved as far as Macon, Ga., and a draw-span should be put in, with not less than 60 feet clear width.

OCONEE RIVER, GEORGIA.

A wooden Howe truss bridge of the Central Railroad of Georgia crosses this river about 30 miles above Dublin, the present head of navigation. As the improvement of the river above this point is in contemplation, this bridge, which is reported to be about 25 feet above low water and without a draw, will be an obstruction to navigation. The remedy should be the building of a draw next the right bank of the river, with not less than 60 feet clear span.

FLINT RIVER, GEORGIA.

The navigation of this river is obstructed, at a point 30 miles below Montezuma and opposite the town of Drayton, by a lattice wagon bridge, which contains no draw and is not at a sufficient elevation. The remedy is the introduction of a draw of suitable width, with sheer-booms if necessary. Within the corporate limits of the town of Albany three bridges cross the river, namely, Brunswick and Western Railroad bridge, the Savannah, Florida, and Western Railroad bridge, and a wooden lattice wagon bridge. The remedy in each case is the introduction of a draw of suitable width, with sheer-booms if necessary.

Opposite the town of Bainbridge, Ga., an iron bridge with a draw crosses this river, and may require the use of sheer-booms after navigation has been opened to Albany.

CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

Two bridges cross this river at the town of Eufaula, which during high water are obstructions to navigation. One of these is a lattice wagon bridge, and the other the Southwestern Railroad bridge. The remedy in each case is the introduction of a draw of suitable width, with sheer-booms if necessary. At the town of Fort Gaines, 35 miles below Eufaula, a lattice wagon bridge crosses the river, which is an obstruction to navigation in high water. The remedy is the introduction of a draw of suitable width, with sheer-booms if necessary.

ALABAMA RIVER, ALABAMA.

A wagon bridge crosses this river at the town of Selma. It is provided with a draw-span having one available opening for navigation. The location of the bridge and of the draw-span are badly chosen, and the draw seems to require supplementary works to assist the passage of boats through it. The matter is under consideration by a Board of Engineers appointed for the purpose.

CAHABA RIVER, ALABAMA.

Navigation is obstructed by the Selma and New Orleans Railroad bridge, at a point about 8 miles above the mouth of the river, and by the Alabama Central Railroad bridge, at a point about 21 miles above its mouth. Each of these bridges has been built without a draw, and the remedy in each case is the provision of a suitable draw, with opening sufficient for navigation, and with sheer-booms if necessary.

CHOCTAWHATCHIE RIVER, FLORIDA AND ALABAMA.

The navigation of this river is obstructed by a wagon bridge, near Geneva, Ala., about 20 feet above low water, and so constructed that it cannot be modified. It should be taken down. The navigation of the river is also obstructed by a similar bridge 7 miles below Newton, Ala., which must also be removed if the improvement of the river is carried to that point.

Very respectfully, your obedient servant,

R. L. HOXIE,
Captain Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN ERIC BERGLAND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Vicksbury, Miss., December 9, 1884.

SIR: In compliance with General Orders No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, I have the honor to submit the following report on bridges and other structures now erected or in process of erection which do or will interfere with free and safe navigation of certain streams within my district, with recommendations as to the best mode of altering or constructing such bridges or structures so as to prevent any such obstructions:

BIG BLACK RIVER, MISSISSIPPI.

(1) A railroad bridge is now in process of erection by the Louisville, New Orleans, and Texas Railway, about 15 miles above the mouth, to replace a light iron bridge heretofore used at this crossing.

The new bridge is an iron truss, of three fixed spans. The lower side of the bottom chord is at the height of extreme high water, which is about 38 feet above low water. The end spans are seventy-five feet long, and centre span 125 feet. The two channel-piers are iron cylinders filled with masonry. The bridge was authorized by act of State legislature, in 1872. It forms an obstruction to free and safe navigation at all stages of water. Another pier should be put in, and the centre span made a pivot-draw.

(2) A county bridge at Hawkinson's Ferry, 25 miles above the mouth. This should be changed into a draw-bridge.

(3) A county bridge at Baldwin's Ferry, 78 miles above the mouth. This should be changed into a draw-bridge.

(4) A railroad bridge, erected by the Vicksburg and Meridian Railway, near Smith's Station, 90 miles above the mouth. It is a "Howe truss," of five fixed spans, 56 feet each, with the bottom chord 7 feet above extreme high water, and 32 feet above low water.

The bridge was authorized by act of State legislature, in 1865. It forms an obstruction to free and safe navigation at all stages of water. One of the piers should be replaced by a pivot-pier and two of the spans by pivot-draw.

Five thousand dollars has been appropriated for the improvement of Big Black River.

SOUTH FORKED DEER RIVER, TENNESSEE.

(1) A log loom, built of piles, at Hosier Mill, about 100 miles above the mouth. The opening through this should be enlarged.

(2) An old railroad bridge, erected by the Narrow Gauge Railway Company, 108 miles above the mouth. This should be removed entirely, being no longer used.

(3) A county bridge at Sharon's Ferry, 114 miles above the mouth. This should be changed into a draw-bridge.

(4) A brush dam, 13 miles below Bell's Station, and 130 miles above the mouth. This should be removed entirely, as it deflects the main body of the river into an artificial channel for the use of private parties.

(5) A railroad bridge, erected by the Louisville and Nashville Railway, near Bell's Station, 142 miles above the mouth. This is a pile trestle, and should be replaced by a pivot-draw.

(6) A county bridge, 145 miles above the mouth. This should be changed into a draw-bridge.

(7) An old county bridge, at Poplar Corner, 160 miles above the mouth. This should be removed, being no longer used.

(8) A county bridge, at Campbell's Landing, 191 miles above the mouth. This should be changed into a draw-bridge.

(9) A county bridge, at McClannahan Landing, 194 miles above the mouth, and 1 mile below Jackson, the head of navigation. This should be changed into a draw-bridge.

Five thousand dollars has been appropriated for the improvement of South Forked Deer River.

Very respectfully, your obedient servant,

ERIC BERGLAND,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR O. H. ERNST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., January 30, 1885.

GENERAL: In compliance with the instructions contained in General Orders No. 13, dated Headquarters Corps of Engineers, July 23, 1884, I have the honor to report as follows upon the subjects therein referred to:

* * * * * * *

2d. Whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions.

The only case of this kind in my district is the steel arch bridge at Saint Louis, which, on account of its arched form, does somewhat impede navigation at the higher stages of the river. The evil is not very serious, as the lower-river boats can temporarily dispense with going above the bridge and the upper-river boats from going below it during the short periods when the passage is obstructed. There is no remedy, for I take it for granted that this magnificent structure is not to be pulled down.

3. There are no bridges in my district having draw-spans or raft-spans.

Very respectfully, your obedient servant,

O. H. ERNST,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., December 12, 1884.

GENERAL: General Orders No. 13, Headquarters Corps of Engineers, current series, requires a report upon certain facts referred to by sections 2 and 8 of the river and harbor act of July 5, 1884.

* * * * * * *

The information asked for in connection with section 2 is desired for presentation to Congress during present session. I would therefore submit herewith a report upon the matters referred to in that section:

* * * * * * *

There are on the Upper Mississippi numerous bridges, causeways, and other structures, in form of piers, wharves, booms, &c., erected by private parties, which interfere with free and safe navigation. Some of these structures have been erected in accordance with acts of Congress, some by authority of State and municipal legislation, and many without any other authority than the private necessities of those building.

The trouble as regards bridges will be partially corrected by the exercise of the authority granted by section 8, river and harbor act of July 5, 1884, but as full protection to the interests of navigation as the circumstances of the case permit can only be secured by constructions in accordance with proper plans.

Section 5254, Revised Statutes, provides for the erection of piers, cribs, &c., under the direction of the Secretary of War, but while a large number of such piers and cribs have been built, I do not call to mind a single instance in which the authority of the Secretary of War has been requested.

Theoretically, private individuals or corporations injured by such structures as are here referred to are protected by law, but experience has shown that practically the laws, in their present form, do not give full protection to the interests of navigation.

The only practical method I can suggest for correcting or reducing the evils resulting from the construction of bridges, piers, booms, &c., on the Upper Mississippi is to declare all such structures as now exist without the authority of Congress, and interfere with free navigation, to be public nuisances, and to prohibit in the future all such constructions as would encroach upon the bed of the river until the same are sanctioned by general or special legislation of Congress.

Such laws would permit in each case a proper consideration of plans in advance of construction.

Very respetcfully, your obedient servant,

A. MACKENZIE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORTS OF MAJOR A. M. MILLER, CORPS OF ENGINEERS.

(1) WABASH RIVER, INDIANA AND ILLINOIS.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., November 28, 1884.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the Wabash River, Indiana and Illinois:

The portion of the Wabash River for the improvement of which appropriations have from time to time been made by acts of Congress, and which is considered navigable, lies between La Fayette, Ind., and the mouth of the river. On this portion of the river, a distance of 214.6 miles, there are twenty-one bridges. Six of these are complete obstructions to navigation by steamboats at and above a medium stage of water, and may be classified under section 2 of the act approved July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

* * * * * * *

They are follows:

(1) *The Main Street bridge at La Fayette, Ind.*—This bridge has a clearance at low water of 31 feet; it is a highway or wagon bridge, has three spans, 175 feet 6 inches, 179 feet, and 175 feet 11 inches, in length; no draw.

(2) *The Lake Erie and Western Railroad bridge, La Fayette, Ind.*—This bridge has a clearance of 31.5 feet at low water; it is a railroad bridge, has four spans of 158 feet 6 inches in width; no draw.

(3) *Wabash, Saint Louis, and Pacific Railroad bridge, Attica, Ind.*—This bridge is a railroad bridge, has a clearance of 37.5 feet at low water, twelve spans, varying from 104 feet 10 inches to 151 feet in width; no draw.

(4) *Chicago aad Great Southern Railroad bridge, Attica, Ind.*—This bridge has a clearance of 33.5 feet at low water, is a railroad bridge, has six spans of 144 feet; no draw.

(5) *Indiana, Bloomington, and Western Railroad bridge, Covington, Ind.*—This bridge has a clearance of 31.5 feet at low water, is a railroad bridge, has four spans from 142 to 144 feet in width; no draw.

(6) *Columbus and Saint Louis Railroad bridge, (narrow gauge,) near Lodi, Ind.*—This bridge has a clearance of 29 feet at low water, is a railroad bridge, has five spans of about 160 feet each; no draw.

All the above bridges require, to render them no obstruction to navigation, to be supplied with draw-spans, placed over the high-water channel, having a width in the clear of 60 feet, and so arranged as to be managed with rapidity and facility. As they now stand, they are at a medium stage of water (8 feet) complete obstructions to navigation by small steamboats, and at high water are obstructions sometimes to rafts and flatboats. In the spring of 1884, the water was up to the bottom chords of some of the higher bridges, and the lower ones were partly submerged.

A recapitulation is given in tabulated form:

Bridges classified under section 2 of the act approved July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, which "now erected or in process of erection do or will interfere with free and safe navigation."

No.	Bridge.	Location.	Clearance at low water.	Proposed alterations.
			Feet.	
1	Main Street bridge, (wagon-way)	La Fayette, Ind.	31.0	These bridges require, to render them no obstruction to free navigation, to be supplied with draw-spans placed over the channel, having a width in the clear of at least 60 feet, arranged to be manœuvred with facility and rapidity, with proper guide-dikes or guard-piers.
2	Lake Erie and Western Railroad bridge, (railway)	La Fayette, Ind.	31.5	
3	Wabash, Saint Louis, and Pacific Railroad bridge, (railway).	Attica, Ind	37.5	
4	Chicago and Great Southern Railroad bridge, (railway)	Attica, Ind	33.5	
5	Indiana, Bloomington, and Western Railroad bridge, (railway)	Covington, Ind.	31.5	
6	Columbus and Saint Louis Railroad bridge, (railway)	Near Lodi, Ind.	29.0	

In addition to the bridges mentioned above, there are two other railroad bridges crossing the Wabash River: (1) The Ohio and Mississippi Railroad bridge, at Vincennes, Ind.; (2) The Louisville and Nashville Railroad bridge, at Grand Chain, Ill., 31 miles above the mouth of the Wabash.

These two bridges are provided with ample draw-spans, with draws in good working order, and suitable guide-piers.

Sketches* showing location and proposed alteration of bridges are forwarded herewith.

Very respectfully, your obedient servant,

A. M. MILLER,
Major Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

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(1) WHITE RIVER, INDIANA.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., December 20, 1884.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the White River, Indiana:

Appropriation for the improvement of White River, Indiana, was first made by act of Congress approved March 3, 1879, and this act and those subsequent, making appropriations until the act of July 5, 1884, directed the appropriation to be expended in improving the river "from Wabash River to Portersville and to falls on West Fork."

The act approved July 5, 1884, makes appropriation for improving White River, Indiana, below Hazleton.

*Sketches omitted.

There are at present no bridges below Hazleton on the White River, but, as appropriations for improving the river as far as Portersville have been made, it is considered proper to report on the bridges below Portersville.

There are two bridges on the White River between Portersville and the Wabash river: (1) The Evansville and Terra Haute Railroad bridge, which crosses the river near Decker's Station, about 2½ miles above Hazleton; (2) The Evansville and Indianapolis Railroad bridge, which crosses the river just above the mouth of the West Fork.

The Evansville and Terra Haute Railroad bridge has four permanent spans of 137 feet in the clear, and a draw-span 54 feet wide between piers. The height of lower chord above water (low) December 5, 1884, was 29 feet. The draw consists of two cranes, each carrying one of the rails, and is manœuvered by swinging these cranes up stream. The draw is situated on the convex bank of the river over the shoalest part; at the time of the examination, December 5, 1884, this bar was 3 feet above the water surface, thus requiring a rise of 10 feet to render the draw available for navigation. The bridge as it now stands is a complete obstruction to navigation at a fair boating stage. The draw should be placed at the other extremity of the bridge, with proper guard-piers and method of manœuvering. A sketch* showing present situation of the draw and bar is appended, marked A.

The In dianapolis and Evansville Railroad bridge crosses the East Fork of the White River just above the mouth of the West Fork. This bridge crosses the river on the piers of the old canal aqueduct, with four spans of 84 feet and one of 175 feet. Under the centre of this last span are the ruins of one of the old aqueduct piers. The height of lower chord above water surface (low) December 6, 1884, was 34 feet 7 inches. The bridge has no draw. The bridge is a bad obstruction to navigation. The piers, being only 84 feet apart, catch large quantities of drift at high stages of water, and the absence of a draw renders the bridge a complete obstruction at navigable stages. The bridge should have a draw placed in it over the channel. A sketch* of bridge is appended, marked B.

Very respectfully, your obedient servant,

A. M. MILLER,
Major Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

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(3) GASCONADE RIVER, MISSOURI.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., January 8, 1885.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the Gasconade River, Missouri.

The only bridge crossing the Gasconade River which can be considered an obstruction to navigation is the Missouri Pacific Railway bridge, crossing the river at a point about 4,000 feet above its mouth, or conflu-

*Sketch omitted.

ence with the Missouri River. The axis of the bridge is oblique to the direction of the stream, making an angle of about 60 degrees with the direction of the river. The piers of the bridge are built with their axes parallel to the thread of the current. There are six spans, of the following widths, beginning with the east span.

	Feet.
No. 1	123 1/3
No. 2	141 5/24
No. 3	74 2/3
No. 4	74 1/12
No. 5	141
No. 6	129 5/8

The centre pier is intended for a swing-draw, the spans on either side being 74 feet 8 inches and 74 feet 1 inch, but these spans are bridged by permanent trusses. The height of the lower chord of the bridge above low water is 32.83 feet.

The bridge is at present an obstruction to the navigation of the river by steamboats. The draw-span should be made operative, and a guide pier or dike be built above and below the pivot-pier.

A tracing* showing plan of piers and down-stream elevation of bridge is enclosed.

Very respectfully, your obedient servant,

A. M. MILLER,
Major Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR CHARLES J. ALLEN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Saint Paul, Minn. December 1, 1884.

GENERAL: I have the honor to submit the following report in obedience to General Orders No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, requiring information necessary to comply with the requirements of sections 2 and 8 of the river and harbor act of Congress approved July 5 last.

* * * * * * *

SAINT CROIX RIVER, MINNESOTA AND WISCONSIN.

The principal obstructions to navigation on this stream consist of lines of piling to carry sheer-booms, and loose logs floating down stream. The Saint Croix Boom Company use the river for collecting and distributing boom-grounds for some 7 miles above Stillwater. During the early part of the season of navigation, the river for about 5 miles of this distance is entirely filled with logs, which at times prevent any navigation of the river by steamers and barges, and until the logs are rafted and distributed, steamers have to take inadequate side channels on the east side of the river. This obstruction continues, during some seasons, for sixty days. Even when the booms are nearly emptied of logs, the lines of piles driven to direct the logs into the booming-grounds are great obstructions.

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*Tracing omitted.

Lumbering is the great interest on the Saint Croix River, overshadowing all others; but the lines of piling and booms should be so arranged as to admit of the booms occupying one side of the river, leaving a channel on the other side for steamers and barges.

CHIPPEWA RIVER, WISCONSIN.

At Round Hill, about 20 miles above the mouth of the river, the Beef Slough Logging Company (a corporation engaged in the driving and assorting of saw-logs) have had for many years a line of boom-piers to support a sheer-boom that directs all floating logs to the left bank of the river, leaving only a passage between the end of the boom and the rocky shore on the left bank of about 130 feet. About one-half mile below this boom is a structure of brush and stone, jutting out from the head of Beef Island, to aid in deflecting logs into the "sorting" grounds in Beef Slough; and at the lower end of Beef Island is a dam connecting the island with the left bank, just below the entrance to Beef slough, to further aid in turning logs into the slough. About 1½ miles below Beef Island is another boom, for the purpose of sheering logs into Little Beef Slough. (See sketch.) These works are entirely in the interest of what is called loose-log navigation, and opposed to steamboat and rafting interests, the booms at times blocking up the channels more or less against the passage of rafts. A conflict has existed for years in regard to these booms between the rafting and steamboat and logging interests.

Assistant Engineer V. D. Simar reported, November 5, for the season of 1884, in regard to these works:

> No complaints of obstructing navigation have thus far been made, to my knowledge. Further encroachments upon the channel by the construction of additional piers should not be allowed, the piers now occupying more space than they should.

About the 1st of July last, the Beef Slough Company drove a number of piles in the Chippewa River, at a point about three-fourths of a mile above its mouth and on the left bank, to form a pocket for the purpose of collecting logs to be sheered into it by a boom on the right bank of the river, and about 400 feet above the pocket. Complaint was made by the Knapp, Stout & Co. Company, a corporation largely engaged in the manufacture and rafting of lumber, they alleging that the boom and piling endangered raft navigation. An examination of this locality was made by Assistant Engineer A. O. Powell, who reported, July 7, that the encroachments of the logging company were jeopardizing the interests of the lumber-manufacturing firms in the Chippewa Valley. The treasurer of the logging company was communicated with at once, by telegraph, and answer returned by him that he would remove the boom and piling if they were in any sense obstructions. He was requested on the 14th to remove them. Subsequently, he called at this office and requested me to personally examine the ground before insisting upon their removal. I examined the works in September, when the stage of water was high, at which time the piling presented no obstruction to rafts or steamers. As the water lowered, the channel shifted towards the group of piles, and complaints against them were renewed. A portion of the piling was removed by parties employed, as I was informed, by the Knapp, Stout & Co. Company. On the 14th

of November, I wrote to the treasurer and manager in general of the Beef Slough Company, requesting him to fulfil his promise, and learned from Assistant Simar that orders had been issued by the manager of the company for the removal of the obstructions.

HARBOR OF DULUTH, MINNESOTA.

Assistant Engineer J. H. Darling reports, in relation to this harbor, as follows:

In compliance with your orders dated July 31, 1884, relating to * * * obstructions to safe navigation, I have to report as follows:

* * * * * * *

As to obstructions to channels, I have observed rafts lying in the main harbor area of Duluth for three or four days at a time, while the logs composing the raft, and owned, I believe, by one F. R. Webber, were being run under the "bridge," one by one, to the Taylor & Fray saw-mill. I have observed such raft twice since I came to Duluth, (in August.)

On the first occasion I took no measurements of its extent, but it extended into the harbor so as to be much in the way of vessels moving about. The second raft noticed by me was brought there about September 19. On that date (according to Inspector Kinnaird) it extended 200 feet into the harbor beyond line of private dredging, or 350 feet from dock-line, and about 500 feet along dock-line. On September 21, I found the same raft to be there, but reduced in size so that it extended about 225 feet from the dock, or 75 feet beyond line of private dredging, and 500 feet along the dock and bridge. I am told that these rafts are sometimes in the way for a whole week at a time.

BRIDGES.

Northern Pacific Railroad Company's bridge across the Red River of the North, at Moorehead, Minnesota, and Fargo, Dakota.—The Northern Pacific Railroad Company recently renewed its bridge across the Red River of the North at Fargo and Moorehead, constructing it so as to afford a draw-opening of 60 feet width. Complaint having been made during the past summer of a number of piling left in the river so as to contract the draw-span, and also that necessity existed for the placing of sheer-booms to aid in the passage of the draw by steamers and barges, the general manager of the company was communicated with on the subject. He promptly caused the removal of the obstructions, and had constructed and placed proper floating sheer-booms above and below the pier, aggregating in length 280 feet.

There are other bridges spanning the navigable waters within the district over which I have charge that may in time need modification, sheer-booms, &c., in the interest of navigation. The provisions of section 8, river and harbor act, approved July 5, can be applied to such bridges when necessity arises.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR W. R. KING, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., January 24, 1885.

GENERAL: In compliance with General Orders No. 13, Headquarters Corps of Engineers, July 23, 1884, I have the honor to submit the following report relative to bridges, booms, &c., which obstruct navigation in the Tennessee and Cumberland rivers and their navigable tributaries:

(1) Under the supposition that pilots and steamboat-men would, from their occupations and interests, be the best authorities on the obstructions met with in navigating these rivers, circular letters were at an early day addressed to a considerable number of the most prominent ones, requesting such information as they or their acquaintances could furnish, and the maps and records of this office, as well as of several railroad offices, have been consulted for the purpose of obtaining all available data relative to the several bridges that formed the subject of investigation.

From the information thus obtained the following tabular statement* has been made:

* * * * * * *

showing the location of the bridges and such facts concerning their structure as could be collected up to the present time:

In considering the question as to whether any given structure is an obstruction to navigation within the meaning of the act of Congress under which this inquiry is made, it seems proper to take note of the fact that most, if not all, of the bridges have been built under State laws, while Congress either approved or was silent on the subject, and this fact, in view of the recent decision of the Supreme Court, to the effect that, Congress being silent, State action must be held legal, would seem to call for a very conservative course in regard to recommending the removal or alteration of bridges, except in cases where the extent of the inconvenience or obstruction to navigation is so great as to leave no doubt as to the justice and necessity for decisive action.

If the bridges were merely projected, instead of being actual structures, it is not probable that more than half a dozen on the list would be approved without some modification of plan or location, but under existing circumstances there are but three of them that appear to demand attention as obstructions within the meaning of the law, viz:

First. The Memphis and Charleston Railroad bridge over Tennessee River at Florence, Ala., which has hitherto been at the head of navigation, but which on completion of the Muscle Shoals Canal will be a barrier to navigation, as it has no draw and is so low that the larger class of steamboats will not be able to pass even by lowering their pipes. This bridge is on a mere branch road, and is a slender structure, both as to masonry and frame, and, judging from the extreme care with which trains are run over it, either a new bridge or extensive repairs will be needed in the near future.

On account of its short spans and location with reference to the current, which is quite strong at that point, two of the piers should be removed, and a single pivot-pier for the draw substituted for them. As the bridge carries a common road on the lower chords and a railroad

*See table with supplementary report herewith.

on the upper, a two-story draw will be required, and I would respectfully recommend that the company be requested to make these changes during the next low-water season. The probable cost of the necessary changes to this bridge would doubtless exceed the $15,000 limit, and might reach $50,000.

Second. The bridge of the Nashville, Chattanooga, and Saint Louis Railroad over the Tennessee River at Johnsonville, Tenn., is a serious obstruction, owing to the faulty location and construction of the draw, and serious damage has resulted to passing steamboats, one or more having been sunk in consequence. The foundations of the draw-piers having been carelessly put in, the river has undermined them, and to prevent this the company has dumped in a large mass of loose stone, which still further narrows the already insufficient channel, and causes troublesome sand-bars to form below the bridge.

I would respectfully recommend that the railroad company be requested to rebuild this draw and widen it, to give a clear width of 125 feet, which, in connection with some contemplated work on the improvement of the channel at that point by the United States, would effectually dispose of this obstruction.

The probable cost of the proposed changes to the bridge would be about $30,000.

Third. The bridge of the Chesapeake, Ohio, and South Western Railroad across the Tennessee River at Gilbertsville, Ky., is also a serious obstruction, chiefly owing to the fact that one of the "rest-piers" for the draw has fallen into the river, and the other is located too near the channel. It is reported that the draw never actually rests upon this pier, and, unless the company wishes to remove and rebuild it in the proper place, I would respectfully recommend that it be torn down and used, with the remains of the one already down, for building wing-dams or otherwise, in connection with the river improvement, making no charge against the railroad company, nor allowing them anything for the stone, in case they decline to promptly remove them.

Fourth. The bridge across the Hiawassee River at Charleston, Tenn., owned by the East Tennessee, Virginia, and Georgia Railroad Company, has no draw, and is so low that none but the smallest steamboats can pass under when there is sufficient water in the stream for a good navigation.

I presume the law would compel the company to put in a draw, but owing to the small amount of steam-navigation necessary for commerce, above Charleston, and to the fact that a draw to be opened perhaps half a dozen times a year would be nearly as great an inconvenience and possible cause of accident to railway travel as a draw on some stream with a hundred times the commerce. It is doubtful whether I would be justified in recommending that the company be required to put in a draw at this place. I have heard no complaint in regard to this bridge for several years, which in a negative way goes to show that there is no great demand for a draw. These remarks apply also to the Louisville and Nashville Railroad bridge over Red River at Clarksville, Tenn.

Other bridges, notably those at Bridgeport and Decatur, Ala., have very narrow draws, but, for reasons already stated, I do not feel justified in recommending their alteration, especially as they are both new bridges, and the work of enlarging the draws would be out of all proportion to the advantage gained.

As the railroad companies owning these and other bridges that have narrow or badly located draws will doubtless construe any failure to report them as obstructions under the law into an approval of the bridges as they stand, I would respectfully suggest that the owners of *all* the bridges on the Tennessee and Cumberland rivers having draws less than 125 feet, clear width, be formally notified that the bridges are obstructions, and that, in case of rebuilding or extensive repairs, they will be required to make the necessary provisions for "free and safe navigation."

The *log-booms* near Point Burnside, Kentucky, in the forks of the Cumberland River, are complained of by raftsmen, and all the action needed to remove these obstructions would be to direct the owners to take them away, or, at least, to confine them to one side of the stream and remove the branch that crosses the channel.

An indirect complaint in regard to these booms was made some weeks ago, and I requested that interested parties would forward written statements of the inconvenience they had been subjected to, but no reply has been received as yet.

Another drift-catching boom across one of the channels in the Cumberland River, about 20 miles above Nashville, has been complained of, and I have taken steps to ascertain the exact extent of the obstruction, but as it is not across the main channel, I am inclined to think that it will prove an advantage to navigation, by closing one chute and compelling steamboats to take the same course at all times, which will tend to keep the channel free from sand-bars.

* * * * * * *

Very respectfully, your obedient servant,

W. R. KING,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SUPPLEMENTARY REPORT.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., February 3, 1885.

GENERAL: Since my report of the 24th ultimo was forwarded, some additional facts relative to obstructions by bridges, &c., have been received, and I would respectfully request that the following statement be added to, and made part of, the report already submitted:

(1) The enclosed tabular statement is more complete than the one forwarded, and is intended to supersede it in the report.

(2) A recent accident at the Clarksville Bridge, on the Cumberland River, has moved the pilots and others interested in the navigation of that river to demand that the space between the draw-piers be filled in by a solid wall, so that boats may rub against it without damage, and that a pole 30 to 50 feet high, bearing a red flag by day and a red lantern by night, so that pilots may see at a reasonable distance whether the draw is open, be erected upon the draw-span. This request seems reasonable, and, as the cost to the company would not be very great, I would respectfully recommend that the necessary orders be given. It may be that cribs of timber filled with stone would answer as well as solid stone-masonry, and the cost need not exceed $5,000 or $6,000.

(3) The purchase of a new steamboat to trade on the Tennessee River between Chattanooga and the head of Muscle Shoals, and the prospect of the completion of the canal around the shoals at an early day, which will bring other steamers of large dimensions into these waters, seems to demand that my recommendation relative to the bridges at *Decatur* and *Bridgeport* should be modified, and I would respectfully recommend that the Memphis and Charleston and Nashville and Chattanooga Railroad companies be required to widen the draws of the bridges in question within the next eighteen months, so that there shall be 120 feet clear space available for navigation. The cost would probably exceed $15,000 in each case, but to make a close estimate would require data not now available.

Very respectfully, your obedient servant,

W. R. KING,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

Tennessee and Cumberland rivers and their tributaries.

Location of bridge.	Owner of bridge.	Number of spans.	Average length of spans available.	Width of draw.	Height above low water.	Height above high water.
			Feet.	*Feet.*	*Feet.*	*Feet.*
Tennessee River at—						
Knoxville, Tenn	County	8	207	None	62.5	19
Knoxville, Tenn	E. T., Va., and Ga. R. R.	8	150	None	61¼	26½
Loudon, Tenn	E. T., Va., and Ga. R. R.	10 deck, 1 thro'.	153	None	75	
Chattanooga, Tenn	C. S. R. R.	9	260	125	64	10½
Bridgeport, Ala	N. and C. R. R	5	140	65½	36½	— 4
Decatur, Ala	M. and C. R. R	12	154½	53½	32½	3.1
Florence, Ala	M. and C. R. R., and carriage.	17	100	None	33½	1½
Johnsonville, Tenn	N. C. and Saint Louis and N. and C. R. R.	9	164	*97	47	2
Danville, Tenn	L. and N. R. R	6	175	98		
Gilbertsville, Ky	Chesapeake, Ohio, and S. W. R. R.	9	160	100	56.3	0.6
Cumberland River at—						
Burnside, Ky	C. S. R. R.	3	180	None	125	
Nashville, Tenn	City		200	None	92	37
Nashville, Tenn	L. and N. R. R	2	200	106	66.6	
Clarksville, Tenn	L. and N. R. R	2	200	90	72	
Eureka, Ky	Chesapeake, Ohio, and S. W. R. R.	3	150	93 at low and 120 at high water.	65	
Holston River, at Strawberry Plains.	E. T., Va., and Ga. R. R.					
French Broad River, at Leadvale, Tenn.	E. T., Va., and Ga. R. R., (branch.)					
Hiawassee River, at Charleston, Tenn.	E. T., Va., and Ga. R. R.	3	120		36	
Clinchi River, at Clinton, Tenn.	E. T., Va., and Ga. R. R., (branch.)	2	150		50	
Duck River, at Columbia, Tenn.	L. and N. R. R					
Red River, at Clarksville, Tenn.	L. and N. R. R					

Boom across south fork of Cumberland River, at Burnside, Ky., for catching logs.
Boom across Cumberland River, at Burnside, Ky., for catching logs.

*Pilot Louis Pell gives 84 feet; and Jas. Till and Sam. Briscoe give: 80 feet—25 feet of rip-rap = 55 feet.

REPORT OF LIEUTENANT COLONEL WILLIAM E. MERRILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, February 5, 1885.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, Washington, July 23, 1884, I have the honor to submit the following report:

The subjects on which I am required to report are the following:

* * * * * * *

(2) Whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and, if they do or will so interfere, to report the best mode of altering or constructing such bridges, or causeways, so as to prevent any such obstructions.

There are many such cases in this district, and I will answer this query in detail. It is necessary to premise that the rivers under my charge are the Ohio, the Monongahela, the Allegheny, and the lower end of the Muskingum.

My remarks will be limited to "bridges," as there are no "causeways" or "structures" to be reported.

BRIDGES OVER THE OHIO RIVER.

These bridges have been an object of care and legislation by the General Government ever since the first one was built, and the only cases in which interference is now necessary are those in which bridge companies have failed to comply with the recommendations of the Boards of Engineers who examined and reported on the plans prior to their erection.

* * * * * * *

BRIDGES OVER THE MONONGAHELA RIVER.

The following table gives a statement of all the bridges over so much of the Monongahela River as is now navigable:

Place and class of bridge.	Distance above mouth.	Number of spans.	Channel-span.		Name of pool in which located.
			Clear width on low-water line.	Clear height above low water.	
	Miles.		*Feet.*	*Feet.*	
Point, highway	0	1	780	73.3	Davis Island dam.
Smithfield street, highway	0.8	2	344	55	Do.
P., C., and T. L. R. R.	1.0	5	247.4	53	Do.
Tenth street, highway	1.3	3	195	54	Do.
B. and O. R. R., (Glenwood)	6.0	8	164 184	59 57	No. 1, Monongahela River.
P., McK., and Y. R. R., (Homestead)	8.0	6	250	54	Do.
P. R. R., (Port Perry)	11.8	9	253	57	No. 1, Monongahela River.
P., McK., and Y. R. R., (McKeesport)	15.5	6	221	40	In No. 2, Monongahela River, Over mouth of Youghiogheny.
Monongahela City, highway	32.5	4	216	33	No. 3, Monongahela River, burnt.
O. and B. S. L. R. R., (Greenfield)	52.0	4	238	52	No. 4, Monongahela River, (unfinished.)
P. R. R., (Redstone)	56.0	4	262	40	No. 4, Monongahela River.
Brownsville, highway	57.3	3	218	41.5	Do.
Morgantown, highway	102.0	1	606	45.7	No. 9, Monongahela River.

Of the bridges included in this table, one of the two lowest is the one at McKeesport, over the mouth of the Youghiogheny. In view of the fact that there is now no navigation on this stream, except such as is afforded near its mouth by backwater from Dam No. 2, on the Monongahela, it does not seem necessary to take any action towards having this bridge raised, but such raising would become a necessity in case the locks and dams that once existed on the Youghiogheny were ever rebuilt.

The new bridge at Redstone and old National Road bridge at Brownsville are now the chief obstructions on the Monongahela, as far as headroom is concerned, although the bridge at Monongahela City (now burnt) was formerly even more objectionable. I would recommend that the standard height of bridges on the Monongahela be fixed at 45 feet above pool-level, and that the bridges at Brownsville and Redstone, and that at Monongahela City, (in case it shall be rebuilt,) be required to conform to this regulation.

No change seems necessary in the widths of existing channel-spans, but in future no channel-span should give less than 250 feet in the clear, and a law to that effect is recommended.

At the Pan Handle Railroad bridge, in Pittsburgh, the channel-span is partly closed by heaps of refuse thrown out from the right bank, and the passage has become dangerous. The channel-span is the only "through" span in this bridge, all the other spans being "deck." I would recommend that the railroad company be required to transform the span adjoining the channel-span on the south, from a "deck" to a "through" span, so that boats can have a second space under which to pass.

At the Tenth Street highway bridge the passage is endangered by piles of rubbish projecting from the right bank, so that it is dangerous to run this span at high water. If these piles are on ground belonging to the bridge corporation, the latter should be compelled to remove them, and to take measures to prevent their reformation in future. If on ground not belonging to the corporation, the latter cannot be held liable, and the matter falls outside of the scope of this report.

At Monongahela City the left pier is directly in the channel, and should be removed, whether the bridge is rebuilt or not.

SUMMARY.

The bridges on the Monongahela which require modification, as stated above, are, therefore, (1) the Pan Handle Railroad bridge at Pittsburg, (2) the Monongahela City bridge, (3) the Redstone bridge, (4) the Brownsville bridge; and the channel-span of the Tenth Street bridge needs restoration to its normal width.

BRIDGES OVER THE ALLEGHENY RIVER.

The following table, prepared by Mr. I. V. Hoag, jr., assistant engineer in charge of Government work on the Allegheny River, shows the existing bridges over the Allegheny between Olean and Pittsburgh. Where a * appears the figures given are estimated. Where bridges are reported as under reconstruction, the future heights and widths are given in the table.

Bridges over Allegheny River between Pittsburgh and Olean.

Place and class of bridge.	Distance above mouth.	Total length.	Number of spans.	Length of channel-spans between centres of piers.	Height in clear above low water.	Character of structure.
	Miles.	*Feet.*		*Feet.*	*Feet.*	
Union, highway	0	1,060	5	212	40	Wooden truss, with arch.
Sixth street, highway	0.5	1,036	4	346	37	Suspension.
North side, (Seventh street,) highway.	0.6	1,080	4	330	40.5	Stiffened suspension.
Ninth street, highway	0.7	1,044	5	209	39	Covered, wooden arch.
P., F. W., and C., railroad	0.9	1,167	9	152	38	Iron lattice truss.
Sixteenth street, highway	1.3	840	4	210	39	Covered, wooden arch.
Pittsburgh Junction Railroad, (33d street)	2.65	841.4	4	210.3 250	43	Open, iron truss.
Forty-third street, highway	3.4	980	4	244	37	Covered, wooden truss.
Sharpsburg, highway	5.3	905	5	181	38	Open, iron truss.
Freeport, railroad	29.6	795	5	185	38	Decked wooden arch.
Kittanning, highway	44.9	900	5	180	32.7	Iron bow-string girder.
Brady's Bend, highway, (1)	69.5	750	4	200	35.7	Howe truss, wood.
Parker, highway	83.1	790	4	197	34.5	Iron bow-string girder.
Foxburg, railroad and highway.	86	530.7	3	176.9	35.3	Howe truss, wood, "through" for highway, "decked" for railroad.
Embenton, highway, (2)	89.6	456	2	228	39	Open, iron truss.
Big Rock, highway	122	700	4	175	27	Wooden truss, new, (1879.)
Franklin, highway	123.1	711	4	175	31.5	Open, wood and iron truss.
Oil City, highway	130.2	700	3	500	41	Suspension.
Oil City, highway, (3)	130.4	1,100	6	200	33	Open, iron truss, with covered sidewalks.
Allegheny Valley Railroad	130.6	450	3	150	29	Open, wood truss and arch, (rebuilt in 1883.)
Tionesta, highway, (4)	150.6	435	4	120	25.5	Iron bow-string girder.
Hickory, highway	156.8*	646	4	161.5	24.1	Howe truss, wood, (1883.)
Tidioute, highway	165.3	536	2	268	27.8	Suspension.
Philadelphia and Erie Railroad.	187.1	450	3	150	18.6	Covered, wooden truss.
Warren, highway	187.7	452	1	452	24.4	Suspension.
B., N. Y., and P. Railroad	188.3*	526	3	175	18*	Howe truss, wood, (1882.)
Glade Run, highway	190.8*	568	4	142	19.8	Howe truss, wood, (1882.)
B., N. Y., and P. Railroad	197.8*	634	4	158.5	22*	Howe truss, wood, (1882.)
Onoville, highway, (5)	212.4*	505	7	82	13*	Suspension, (1884.)
Quaker Bridge, highway	218.2	300	4	75	17.5	Wood, Queen truss.
Red House, highway, (6)	224	375	3	125	20	Open, iron truss, (1881.)
West Salamanca, highway	230	643	4	118	20	Open, iron truss.
B., N. Y., and P. Railroad	231.1*	394	3	146	22.5*	Howe truss, wood, (1883.)
Salamanca, highway, (7)	231.8	400	3	133⅓	15	Parabolic truss, iron, (1883.)
South Carrolton, highway	237.8*	280	6	84	17*	Wooden truss, (1883.)
Tuna Creek, highway, (8)	239.9	274	2	137	26	Open, iron truss.
Erie R. R., Bradford Branch, (9).	240.3	192	1	203	13*	Open, iron truss, (1883.)
Rochester and Pittsburgh Railroad.	240.3	203	1	203	15*	Open, iron truss, (1882.)
Allegheny, highway	250.6	400	4	100	19.4	Iron bow-string girder.
B., N. Y., and P. Railroad	251.4*	329	2	164.5	16*	Howe truss, wood, (1883.)
B., N. Y., and P. Railroad, (10)	253.7	300	3	100	20	Howe truss, wood.
Olean, highway	255	240	3	80	16.5	Iron truss.

(1) Superstructure gone, but the piers still remain.

(2) Destroyed by ice in February, 1883. Rebuilt same year, at an increased height of 5 feet.

(3) In process of reconstruction, at an increased height of 4 feet.

(4) During 1884 one span of this structure was taken down, and a new span erected on the original piers, and at the original elevation.

(5) The construction of this bridge is very primitive, consisting simply of two 2-inch wire-ropes passing over piling driven into the bed of the river, from which is suspended a very cheaply constructed floor.

(6) This is a combination bridge of three spans. One span fell in 1880, a second was carried away by high water in the spring of 1881, and the third was taken down and a new structure was erected. The clear width of channel has been reduced 7 feet, and the height above low water has been reduced 1 foot.

(7) In 1883 the superstructure of this bridge was taken down, and a new one was erected on the same piers, having an increased length of channel-span of 48⅓ feet, and a decrease of 4.2 feet in the height in the clear over the channel.

(8) The superstructure, originally a Queen truss, of wood, is at present being removed, and a new one is in process of construction, having an increase in length of channel-span of 33 feet.

(9) The superstructure was originally a wooden Howe truss, which was taken down in 1883; a new one was erected, having an increased length of 7 feet, and a decrease in height over the channel of 1.7 feet.

(10) In process of reconstruction, without change in height or channel-span.

It is undeniable that steamboat commerce on the Allegheny has been almost destroyed by low bridges. Formerly there was a valuable river trade between Oil City and Pittsburgh, but the great danger and difficulty of making a trip under present conditions has acted as an embargo, and the steamboat interest on the Allegheny is practically extinguished.

In my judgment, this river commerce has been illegally destroyed, and public interest requires that so magnificent a stream as the Allegheny should be restored to commerce. Since 1879 the United States has expended, under my direction, $105,000 in improving the navigation of this river, and Congress by its appropriations has classed the Allegheny among the navigable rivers of the United States. As such, navigators have a right to demand that existing artificial obstructions should be removed.

The trade on this river which should be restored is the towing trade, as there is no probability of any future passenger traffic. A large business could be developed in towing barges laden with oil in bulk, coal, limestone, staves, building-stone, sand, gravel, and generally with all heavy products which railroads cannot afford to handle.

Every consideration of equity requires that the same protection should be extended to the river commerce of the Allegheny as is now granted to similar commerce on the Monongahela. I would, therefore, recommend for the Allegheny, as I have done for the Monongahela, a head-room of 45 feet, and a minimum channel-space of 250 feet in the clear. These conditions, however, should only apply on the river below Oil City. Above Oil City it is not now necessary to provide for steamboats, although their wants will have to be considered whenever the Allegheny is locked and dammed, a condition which is not impending at this present, although it may fairly be expected in the future. There is a necessity, however, of providing for the safety of rafts and raftsmen by requiring channel-spans to have a minimum width of 200 feet, and a height of not less than 10 feet above high water.

The Union bridge, at the mouth of the Allegheny, was built in 1874, and the effect of its construction was to destroy the ship-building and repairing interest on the Allegheny River below the Sixth Street bridge. For a full report on this bridge, I would refer to the Annual Report of the Chief of Engineers, 1875, Part II, page 684. In that report I recommended that this bridge should be required to provide a draw-span giving two clear openings of 120 feet. The other alternative is to require the superstructure to be raised to the same height as that of its immediate neighbor, the Point bridge, which spans the Monongahela at its mouth. The clear height under the last-named bridge, measured to the surface of the pool of the Davis Island Dam, is 73 feet.

I would therefore recommend that the owners of the Union Bridge be required by proper legislation to change their bridge so as to make it conform to either of the two plans herein outlined.

SUMMARY.

I recommend that all bridges over the Allegheny River between Pittsburgh and Oil City (except the Union Bridge) be required to have a channel-span giving a clear width between piers of 250 feet, and a clear height above low water of 45 feet, and that all bridges between Oil City and Olean be required to have a channel-space giving a clear width between piers of 200 feet, and a clear height of 10 feet above high water. The Union Bridge, across the mouth of the Allegheny, should give a clear height above the pool of the Davis Island Dam of 73 feet, or else should be provided with a draw giving two clear openings of 120 feet each.

If these recommendations are carried into effect, every bridge on the river will require raising except the highway bridges at Tionesta and Tidioute. The suspension bridge at Warren should also be excepted, as it is only a few inches too low. I think that the proposed requirement as to height should be enforced, as it is comparatively easy to jack up and underpin a bridge, and deficiency in height is the most serious possible defect in the relations of a bridge to navigation.

As all of the bridges on the Allegheny have been built under State law, which contained no precise requirement as to width of channel-space, I would recommend that no action be taken against any bridge between Pittsburgh and Oil City that gives a channel-space of 200 feet, or against any bridge between Oil City and Olean which gives a channel-space of 150 feet.

The bridges, therefore, that under this recommendation would be required to widen their channel-spans are reduced to the following: Pittsburgh, Fort Wayne, and Chicago Railroad, at Pittsburgh; Sharpsburg, highway; Freeport, railroad; Kittanning, highway; Parker, highway; Foxburg, railroad and highway; Big Rock, highway; Franklin, highway; Allegheny Valley, railroad, at Oil City; Tionesta, highway; Glade Run, highway; Salamanca, highway; South Carrolton, highway; Tuna Creek, highway; Allegheny, highway; Buffalo, New York, and Philadelphia Railroad; Olean, highway.

BRIDGE AT MOUTH OF MUSKINGUM RIVER.

The Baltimore and Ohio Railroad bridge spanning this river near its mouth has no draw on the side where the United States is building a large lock, for the purpose of enabling steamboats and barges to enter Pool No. 1 of the Muskingum River for safety from ice in the Ohio.

This draw is not now necessary, but it will become so when the lock in question is completed and the State lock on the Harmar side is removed. The draw should be so built that the free space between the pivot-pier and the present eastern abutment of the bridge would not be less than 80 feet.

* * * * * * *

Respectfully submitted.

WM. E. MERRILL,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., October 30, 1884.

GENERAL: In compliance with the instructions of General Orders No. 13, July 23, 1884, Headquarters Corps of Engineers, I have the honor to submit the following "final report" on the subject therein referred to:

ELK RIVER, WEST VIRGINIA.

The old lock and dam near Charleston, West Virginia.—In the Annual Report of the Chief of Engineers for 1876, (page 167, Part 2,) it is stated "a poor dam and lock, badly located, have been built about 2½ miles above Charleston, under State authority; these should be removed." Reference may also be made to my report and that of Captain Ruffner to me, and the letters and indorsements published therewith, in the Annual Report of the Chief of Engineers for 1882, pages 931 to 934, Part 1. The legal status of the work, or the authority under which it was built, is shown by the papers referred to.

By the decree of the circuit court in an action for debt against the Elk River Navigation Company, in which the State Bank of West Virginia of Charleston was plaintiff, the property and franchise of the company were sold October 14, 1880. The purchasers were Andrew Brockerhoff, J. D. Cameron, Jacob Tome, Moses Thompson, and John I. Thompson, all of Pennsylvania.

An indictment against the company for obstructing the navigation of Elk River has been pending for several years, but the authorities have, on account of the absence of representatives in this State, never been able, as alleged, to serve process, and nothing at law has ever really been done.

The lock was so miserably constructed that it was out of order and could not be worked a great deal of the time from the first. In September, 1881, navigation having been entirely interrupted by it for some months, a force of men—it is commonly referred to as a "mob"—cut a sluice through the dam. This sluice is now about 70 feet wide, and has cut out down to or below the bed of the river. Canoes, bateaux, rafts and logs, and small steamers, in navigable stages, pass through it. It is still too narrow for certain stages of water, and at least 75 feet more of the old dam should be removed. There is also a high bar just below the dam, formed mainly by material (mostly large stone) from the dam. This should also be removed.

The lock and dam is a complete ruin, and will never be repaired it is supposed. It appears to be a clear case of abandonment on the part of the owners.

Elk River boom.—"The Elk River Boom Company," the present owners of the boom located about 3½ miles above the mouth of the river, are the successors of "The Elk River Land Improvement, Manufacturing, and Booming Company," incorporated by act of legislature passed February 27, 1869. Section 3 of the act reads as follows:

> The said corporation are authorized and empowered to erect and maintain on Elk River, at any point or points between its confluence with the Great Kanawha River, at the city of Charleston and village of Sutton, in Braxton County, such boom or booms, with or without piers, as may be necessary for the purpose of stopping and securing

logs, masts, spars, and other timber, and to erect such piers and side, branch, or sheer-booms on said river, or any of its tributaries between the points above mentioned, as may be necessary for that purpose; and also to erect and maintain branch or sheer booms at any point or points on the Elk River as far up said river as the mouth of the Holly, one of the tributaries thereof, and shall have exclusive privileges, provided that said booms be so constructed as to admit the safe passage of rafts and boats, and not prevent the navigation of said river or tributaries.

As the result of a suit against the original company, wherein Robert M. Given was complainant, and of another wherein C. D. Copen was complainant, the franchise and property of the company were sold by order of court, and at the November term, 1878, the United States district court approved the sale, and decreed that Mr. Wm. A. Quarrier, as special commissioner, should convey the same to the purchasers, Wm. A. Bradford, of Charleston, West Va., and others associated with him, under the corporate name of the Elk River Boom Company.

The boom has been and is still considered by a considerable number of citizens of Elk River, lumber-men, &c., an obstruction to navigation, and an indictment was found against the present company in March, 1884. The case was tried here before the Circuit (State) Court in June last, but the jury failed to agree. It will be tried again soon, probably at the next term of the court.

The boom at present consists of one abutment and thirteen timber and stone cribs, each about 20 by 40 feet in plan and 23 feet high, starting from the left bank and extending up the river about 2,000 feet. The river here at ordinary boating or rafting stages is about 290 feet wide. The opening left for the passage of craft between the right bank and the boom cribs is, at a 5-foot stage, at the head or narrow part, about 85 feet in width, about 200 feet of the river at this stage being occupied by the cribs and boom.

The principal complaints made against the boom are:

(1) The difficulty of entering or getting over into this passage, the direction of the current being such, it is claimed, caused by a bend in the river above, as to make it difficult in high stages to keep from running into the boom or against the upper crib.

(2) The tendency of the passage to fill up with deposit, sand, &c.

The company has recently done some dredging in and above the passage, but the opponents of the boom claim that this will soon fill up again.

The boom, it will be remembered, is about one mile above the old lock and dam. It appears there was little or no complaint about the boom as regards navigation when the pool was full, or before the cutting of the dam. Both of these works, though under the name of different companies, were during construction and for some time afterwards owned, in part at least, by the same men, and were practically under one management. At present, as shown above, the interests and ownership of the lock and dam and of the boom are entirely distinct.

Low grist and saw mill dams in the upper part of the river.—In my report dated January 21, 1880, and that of Captain Turtle to me of December 16, 1879, (Report of Chief of Engineers for 1880, pages 691–2, Part 1,) reference is made to these dams. Captain Ruffner in his report dated June 14, 1881, (Report of Chief of Engineers, 1881, page 917, Part 1,) also refers to them. Nothing has yet been done towards having them removed.

There are now between Braxton Court-House (Sutton) and the mouth of the river eleven mill-dams. From the best information I can gather, but five of them, viz., Huffman's, Frame's, Birch River, Duck Creek, and Ashley's, are considered anything like serious obstructions, the two first mentioned being by far the worst, and forming really serious impediments to navigation.

The remaining six are either wing-dams, not materially obstructing the channel, or are built so low as not to be troublesome in log or boating stages.

It appears that these dams are built under State charters or by authority granted by the county courts. It is conceded that the courts have no right to grant privileges of this kind that would interfere at all with the navigation of the river. Up to this time there has been very little legal complaint against any of these dams, and, so far as I am informed, no effort worthy of notice has ever been made to get any of them removed or modified to conform to charters.

BRIDGES.

There are two bridges across Elk River at Charleston, one wagon and one railroad bridge. There has never been any complaint made, so far as I am informed, of either of these bridges as interfering with navigation. Both are *lower*, however, than they should be, particularly in view of the probabilities of future navigation and conditions, and it seems proper to refer to them in this report.

Suspension (wagon) bridge.—The first above the mouth of the river is the wagon bridge, a wire suspension, built by a company incorporated by act of the assembly of Virginia, passed March 27, 1848. Section 5 of the act requires the bridge to be "so located and constructed as not to injure or impede the navigation of Elk River."

The bridge was finished about 1855. The State of Virginia helped to build the bridge and owned part of the stock, about two-fifths of it. The main cables of the bridge were cut by the forces under General Lightburn when retreating from the valley in September, 1862. By an act of the legislature of West Virginia, passed February 28, 1865, the State relinquished her interest in the bridge to the other stockholders, provided they would rebuild. This was done. It is a toll-bridge, owned by "The Elk River Bridge Company." Mr. Joseph Bibby, of Charleston, is president and controlling member. The bridge is 488 feet long between towers, which stand on the tops of the banks, and over the channel is 38½ feet high in the clear above low water of 1872.

The Ohio Central Railroad bridge.—This bridge was finished last season, under authority of an act of the legislature of the State, passed February 10, 1882. It is located about one-fourth of a mile above the suspension bridge. The act authorizing its construction required the channel-span to be not less than 200 feet in the clear, and all the spans to be at least as high above the surface of the water as the suspension bridge. It is an iron Pratt truss bridge, of three spans—a centre span of 209 feet, (200 feet at low water,) with shore spans of 100 feet each. At present the low-water width of the channel-span is contracted by the embankments of the coffer-dams, which have not been removed. The clearance under the whole bridge is 40.40 feet with reference to low water of 1872.

The steamboat navigation of Elk River is at present of no great importance; ordinarily one small packet makes daily trips to the mouth of Big Sandy, 21 miles up. There is water enough, on an average, for this trip about two hundred and fifty days in the year. Out of this may be taken from four to six weeks' interruption by ice. These small boats can pass under the bridges, with stacks down, up to about 18 feet by Charleston gauge. The record shows the water to be at and above this about eight days in a year.

The main difficulty is in the fact that larger boats, the smaller sized Kanawha tow and freight boats, are unable, except in low stages, to go under the bridges at all, and it is often desirable to reach the numerous mills, &c., located between and above the bridges. This inconvenience will be more felt as the lumbering interests of Elk are developed and the mills and factories increase. The bridges over Elk near Charleston should be at least 48 feet in the clear above low water. This would enable the smaller sized Kanawha boats to pass under up to about a 16-foot stage, or at all times except about twelve days in the year. Such a requirement, as shown, would compel the raising of the railroad bridge about 8 feet and the suspension bridge 9½ feet. It is probable that the river interests will before many years demand at least this height.

In conclusion, the following suggestions are respectfully submitted: It appears that up to this time the State has assumed entire control of these works on Elk River, and that all efforts thus far made to get any of them removed or modified have been with the State. Considering this, the nature of the present navigation and the limited character of the improvement thus far attempted by the United States, it does not appear necessary or advisable, at present at least, for the General Government to take control of the river or to interfere with the regulation of structures as reported on herein, either in or across it.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, February 3, 1885.

GENERAL: In compliance with General Orders No. 13, Headquarters Corps of Engineers, dated Washington, D. C., July 23, 1884, I have the honor to submit the following report giving the information required in section 2 of the river and harbor act of July 5, 1884, so far as relates to the rivers in the district under my charge:

The section referred to is as follows:

SECTION 2. That the Secretary of War shall * * * report whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and, if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstruction.

* * * * * * *

As regards the information desired in this paragraph, I have to state that the navigation of but four of the rivers of which I have charge is restricted or in any way affected by bridges, dams, or other structures. These are the Kentucky River, Kentucky; the Little Kanawha and Guyandotte rivers, West Virginia; and Big Sandy River, Kentucky and West Virginia.

KENTUCKY RIVER.

This river has been improved by slack-water navigation from its mouth to 17 miles above Frankfort, a distance of 82 miles, by the construction of locks and dams, and it is proposed to extend this improvement an additional distance of 170 miles. At present there are eight bridges crossing the river. They are as follows:

Where located.	Distance from mouth of river.	Object of structure.	Number of spans.	Length of channel-span.	Height of bridge above low water.	Remarks.
	Miles.			*Feet.*	*Feet.*	
Worthville	8	For Louisville and Nashville Railroad.	5	201½	52⅔	Iron; three through and two deck.
Frankfort, foot of Broadway.	65.25	For Louisville and Nashville Railroad.	3	162½	38⅓	Iron; one through and two deck.
Frankfort, foot of Saint Clair street.	65.75	For county	4	111¾	36⅓	Wooden; through bridge.
Brooklyn	112.75	For turnpike	3	175	68	Iron; through bridge.
High bridge	116.65	For Cincinnati Southern Railroad.	3	342	285	Iron; deck bridge.
Hickman	135.2	For turnpike	1	240	70	Wooden; through bridge.
Cleveland	170.3	For turnpike	2	216½	65	Iron; through bridge.
Boone's Ford	177.1	For Kentucky Central Railroad.	2	305	80	Iron; through bridge.

But three of these bridges, those first named, restrict navigation.

The commerce of the river is carried upon a number of steamers, which make frequent trips. The largest of these measures 34 feet from the surface of the water to the top of the pilot-house. As this steamer is as large as the locks now in operation will accommodate, its height may be taken as regulating the amount of headway that will be required for free and safe navigation.

The bridge at Worthville is 52.67 feet above the level of Pool No. 1. Assuming that 35 feet is required under the bridge, 34 for the height of the steamers, with one-foot clearance, a rise of 17.67 feet stops navigation. To give unrestricted navigation, according to the records of the height of the water in 1884, would require that this bridge be raised 28.26 feet, as the water stood at a height of 41.93 feet above normal pool level. This, however, is regarded as excessive, as it is based upon the unusual flood last year in the Ohio River, which backed the water up in the Kentucky. If this bridge was raised 10 feet, which would make its height 62.67 feet above pool level, and permit a rise of 27.67 feet in the river before navigation was interfered with, it would be considered sufficient for all the necessities of commerce. Navigation could then be continued to Frankfort, the principal point upon the river, during all ordinary stages of high water, and if it should be suspended by the water rising higher, the delay would probably amount to only a

few days, and not seriously affect commerce. I know of no serious difficulty in the way of the railroad company raising this bridge as proposed. The width of the channel-span of this bridge is sufficient for the accommodation of navigation.

The two bridges at Frankfort, respectively 36.33 feet and 38.33 feet above pool level, greatly restrict the passage of steamers desiring to proceed above Frankfort. The following table gives the number of days during each month of 1884 that they obstructed navigation, taking, as before, 35 feet as the headway required. From this it will be seen that a rise of 1.33 feet and 3.33 feet above pool level will prevent the passage of steamers under them.

Number of days during each month of 1884 *that the water was more than* 1.33 *feet*, 3.33 *feet, and* 11.33 *feet above level of Pool No.* 4, *Kentucky River.*

Months.	Above 1.33 feet.	Above 3.33 feet.	Above 11.33 feet.
January	28	20	.....
February	29	24	17
March	31	26	6
April	27	7	.....
May	19	.....	.....
June	1	.....	.....
July	.....	.....	.....
August	.....	.....	.....
September	.....	.....	.....
October	.....	.....	.....
November	.....	.....	.....
December	5	.....	.....
Total	140	77	23

It will be seen from this that the railroad bridge prevented navigation 77 days, or 21 per cent. of the year, and the Saint Clair Street bridge 140 days, or 38 per cent.

The Saint Clair Street bridge was built under a charter granted by the Legislature of the State of Kentucky, approved January 25, 1810, and is owned jointly by Franklin County and the city of Frankfort. It is the only direct means of communication between Frankfort and South Frankfort. The bridge is not only too low, but by being divided into four short spans greatly obstructs navigation. The piers, especially the one in the channel, which is next to the Frankfort shore, catch quantities of drift during the season of high water, which usually closes the water-way under at least two of the spans. Lately a proposition has been considered for removing this bridge and replacing it with an iron one to be composed of two nearly equal spans, the shorter one being 206 feet in length, and whose height will be 46.33 feet above the pool level, or 10 feet higher than the present bridge. This height will permit steamers to pass under the bridge during all stages of water up to 11.33 feet above normal pool level. By referring to the last table it will be seen that the water was above this height but twenty-three days during the year 1884. Without additional data, it is impossible to state definitely whether the height of the water during last year, would represent those of an average year, but it is believed that they are sufficient to enable a fair approximation to be made of the amount of obstruction that a bridge of the proposed height would be to navigation. The approaches to the bridge are now nearly level, and it is part of the plan to obtain the increased height by raising the streets and establishing a

grade to the bridge. This, however, cannot be done so as to obtain still greater height without probable damages to the property along the approaches, or making too steep a grade, and therefore an additional height has not been considered. It is also regarded inadvisable to recommend that a draw be placed in the bridge, as it would then be an obstruction to both navigation and to the travel, which is almost constant between the two parts of the city, besides being a source of danger to both. Considering these facts, and the few days in each year that a bridge constructed 46.33 feet above low water would interrupt navigation as indicated by the record of 1884, and that with but one pier there would not be likely to be sufficient accumulation of drift to obstruct the channel, I believe that a bridge constructed according to the plan proposed would satisfy all reasonable demands of commerce. I therefore recommend that the bridge be rebuilt with these modifications. Beyond discussing it generally, so far as I can learn nothing has yet been done towards rebuilding this bridge, and it may be necessary for Congress to take some action before it will be done. It has been suggested to me that the United States should bear part of its cost, but I know of no claims upon which this can be justly urged. The present bridge is very old, and the piers are greatly out of repair, and it will not be many years before a new bridge becomes a public necessity.

* * * * * * *

A drawing* of the present bridge and of the new one with the modifications recommended accompanies this report.

The height determined for the new Saint Clair Street bridge also determines the height to which the Louisville and Nashville Railroad bridge at Frankfort should be raised, as these bridges, to give equal freedom to commerce, should be of the same height. The railroad bridge is at present 2 feet higher than the Saint Clair Street bridge, and therefore it should be raised 8 feet. It is believed that this can be done without any unusual difficulty. The length of the channel-span in this bridge, which is at present 162 feet, should be increased to at least 200 feet, which is the minimum width that will fully accommodate the commerce of this portion of the river.

LITTLE KANAWHA RIVER.

The only bridge crossing the Little Kanawha River is at Parkersburg, about 1,100 feet from its mouth. This bridge belongs to Wood County, West Virginia. It has one clear span of 293 feet in length between the abutments, and is 42.8 feet above the water when it is at zero on the gauge. With the water at an 18-foot stage it prevents the larger boats of the Little Kanawha River from passing into the Ohio River. The water is at this height, or about it, as near as I could ascertain, about eighty days during each year, or nearly 22 per cent. of the time.

The mouth of this river is also used as an ice-harbor for the Ohio River boats. It is regarded as a safe harbor, and is used for this purpose whenever there is running ice. I am informed that as many as eleven steamers have put into this harbor at one time for protection. A thorough discussion of the Little Kanawha River as an ice-harbor is contained in the Report of the Chief of Engineers for 1880, page 1790, and was submitted by Maj. W. E. Merrill, Corps of Engineers. The conclusion he came to, after fully considering the conditions, was that

* Drawing omitted.

because of the limited extent of the river available for this purpose, it being cut off from the portion above, except for smaller boats, by the bridge mentioned, that it would be better to form an artificial ice-harbor in the Ohio River near this point. This plan, however, even if carried out, would be of little or no benefit to the navigation of the Little Kanawha. If the bridge were removed, which could only be effected by the United States buying it and taking it down, the portion of the Little Kanawha available as an ice-harbor for all steamers would then become from 2 to 3 miles in length, and navigation would be unrestricted. It may be well to observe here that both above and below the bridge the river is 100 feet wider than the distance between the abutments. If the bridge is to be preserved, there are but two methods remaining by which navigation may be aided, first, by raising the bridge, and second, by converting it into a drawbridge. As it is considered impracticable to raise it sufficiently, it is deemed best to recommend that it be made into a drawbridge, by building a middle pier. A drawing * is forwarded with this report showing the bridge as it is at present and with the proposed modification. It will be observed that there will be a width of 128.5 feet between the turn-pier and the abutment. This change will materially aid navigation in the higher stages of water, and will also give the mouth of the river greater value as an ice-harbor.

It is proposed by the Ohio River Railroad, I have been informed, to build a bridge across the Little Kanawha River at its junction with the Ohio River, this bridge to be given an elevation of 60 feet above low water. A bridge of this height will effectually prohibit the use of the portion of the Little Kanawha now available as an ice-harbor by all the larger Ohio River boats seeking refuge from the ice. From the accounts I have received from this locality, during the present winter its great usefulness in preserving valuable property from destruction has been clearly proven, and I regard it as highly important to commerce that it should be preserved. I therefore recommend that if a bridge is built at this point it be required to conform with the laws regulating the construction of bridges across this portion of the Ohio River.

If the railroad company desires to construct a lower bridge, a location might be selected above the county bridge. A bridge crossing this part of the river might even be built as low as the county bridge, provided it was constructed with draws as required for this bridge, and also, if the bridges were near together, that the draws were directly opposite to each other.

GUYANDOTTE RIVER.

Under the acts of Congress, beginning with 1878, small sums have been appropriated for improving this river. They have been used for clearing the channel of obstructions, such as dams, bowlders, snags, and trees. This river is now in good condition from its mouth to Logan Court-House, a distance of 81½ miles, with the exception of at two places, where there are mill-dams. These dams, known as Rogers and Peck's, respectively, 13 miles and 74 miles from the mouth of the river, according to the best information I can obtain, were constructed under the laws of the State, and therefore cannot be removed, except by pur-

* Drawing omitted.

chase or process of law. They are exceedingly dangerous to navigation, especially the former, which has already caused the loss of several lives. Mr. Rogers desires to sell his dam, and wants $2,000 for it, and I have no doubt that the Peck Dam may be purchased for a like amount.

By act of July 5, 1884, Congress appropriated $2,000 for the improvement of this river. Before work was commenced under this act, it was ascertained that the most needed improvement was the removal of these dams. The raftsmen upon the river requested that the Rogers Dam be purchased, agreeing to remove it free of cost if it was done. It was, therefore, thought best to await the further action of Congress before expending the sum appropriated in the last river and harbor act. It is recommended that both these dams be purchased and removed.

BIG SANDY RIVER.

The Chesapeake and Ohio Railroad bridge crosses this river 1½ miles from its mouth. It has three spans, 202 feet 7½ inches, 208 feet 9 inches, and 205 feet 3 inches, respectively, commencing on the West Virginia or channel side of the river, and is 72 feet 10 inches above low water. Its direction has an angle of 63 degrees with the general course of the river. This bridge does not interfere with navigation during the ordinary stages of high water, and is not considered an obstruction, except so far as relates to a number of piles and a portion of a coffer-dam that has been left around the pier on the West Virginia side of the river. These render navigation difficult and dangerous, and should be removed.

The navigation of the two remaining rivers under my charge, the Buckhannon, West Virginia, and the Tradewater, Kentucky, is not interfered with by bridges, dams, or other structures.

* * * * * * *

Very respectfully, your obedient servant,

JAS. C. POST,
Captain of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN W. L. MARSHALL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., December 13, 1884.

SIR: In accordance with the requirements of General Orders No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, and of section 2 of the river and harbor act of July 5, 1884, I have the honor to make the following detailed report for the works in my charge:

* * * * * * *

(2) FOX AND WISCONSIN RIVERS, WISCONSIN.

Wisconsin River.—There is at present no navigation except rafting on this river, and the improvement has not as yet progressed sufficiently to fix permanently the channel at any point crossed by railroad or other bridges. The bed of the river is shifting sand, and although it is

crossed by several bridges, it is not practicable, in advance of the rectification of the river, to indicate in what manner, if any, these bridges will obstruct navigation, or what changes will then be necessary in them to meet the requirements of navigation. At present, no changes that will probably permanently accommodate even rafting navigation can be recommended.

* * * * * * *

BRIDGES ON THE FOX RIVER AND PORTAGE CANAL WHICH REQUIRE MODIFICATION.

(1) *The Chicago, Milwaukee, and Saint Paul Railroad Bridge, (main line,)* across the Portage Canal, belongs to the Chicago, Milwaukee, and Saint Paul Railroad Company. It is located in a bend in the canal, and has a clear opening of only 52 feet. The south abutment projects into the canal, and is an impediment to the free passage of this bridge-draw. The draw itself strikes the sidehill before it is fully open, and consequently overhangs the canal and endangers boats passing along that side, especially when there is any wind.

Remedy proposed.—Excavation should be made at once to allow the draw to fully open out of the way of passing boats. The projecting abutment should be removed from the south side, leaving the canal revetment unbroken, and the draw widened to 60 feet, which is considered the least practicable span consistent with free navigation.

(2) *Ketchum Point Bridge*, across the Portage Canal, belongs to the city of Portage. It is of sufficient width of span, and requires only a few guard-piles to assist boats in passing.

(3) *The Chicago, Milwaukee, and Saint Paul Railroad Bridge, (old line,)* across the Portage Canal, belongs to the Chicago, Milwaukee, and Saint Paul Railroad Company. Both abutments of this bridge project into the canal, and seriously obstruct navigation. The clear span is narrowed to 42 feet, and the south abutment projects so that the whole of this 42 feet is not available.

Remedy proposed.—The company should modify the bridge to give a clear draw-span of 60 feet, and remove the projecting abutment from one side of the canal, to leave the canal revetment on that one side straight and unbroken, as a guide for passing boats.

(4) *The Wisconsin Central Railroad Bridge*, across the Fox River, between Fort Winnebago and Governor's Bend Lock, belongs to the Wisconsin Central Railroad Company. This bridge is located in a most objectionable place, at a very abrupt, reversed bend in the Fox River, just below a very short bend in the river, and at a narrow point. As it is now, the open draw projects into the river, endangering boats, and, from the location of the bridge, it is the most serious and dangerous obstruction to navigation on the Fox River. It has already put the Government to expense for dredging to improve the situation, and prevents any rectification of the bend, which, of itself, is a serious but remediable obstruction.

Remedy proposed.—The bridge should be removed, its location changed. If it could be moved only 200 feet down stream, the situation would be greatly improved. If allowed to remain at its present location, which is not recommended, the draw should at once be made to open entirely out of the way of boats, the left bank of the river near the draw be bulkheaded or revetted even with the face of the abutment, as a guide to

descending boats, for a distance of at least 75 feet above the upper end of the draw when open to 30 feet below the bridge abutment.

(5) *Float-bridge across the Fox River at Port Hope*, belongs to the town of Fort Winnebago. It needs only guard-pile protections on each side of the opening, above and below, as guides.

(6) *Float-bridge at Packwaukee, Wisconsin*, belongs to the town of Packwaukee. This bridge has a clear opening for navigation of but 47 feet, and its location on Lake Buffalo is greatly exposed to winds.

Remedy proposed.—The method of holding the floating draw should be changed to allow the draw portion to swing in behind the causeway, instead of projecting into the opening, and the approaches on each side of the opening above and below should be well protected by guard-piles, to guide boats and prevent their being blown against the ends of the causeway.

(7) *The highway bridge at Princeton, Wisconsin*, belongs to the town of Princeton. The left opening only is available for navigation. The clear opening is only 47½ feet, at right angles to the current. The bridge is dangerous.

Remedy proposed.—The clear opening should be enlarged to 60 feet, at right angles to the channel, and the left opening be protected with spring-piles, to prevent boats striking the stone piers, especially in windy weather.

(8) *The bridge at Berlin, Wisconsin*, belongs to the city of Berlin. The right opening is not passable by boats on account of shoal water and bowlders. A direct approach to the left opening from above is prevented by a projecting log-boom. The obstruction to navigation results from this boom.

Remedy proposed.—The log-boom should be removed or narrowed to one-half its present width. The laws of the State of Wisconsin cover the case. (Revised Statutes, Wisconsin, section 1598, page 478.)

(9) *Highway Bridge across Fox River at Omro, Wisconsin*, belongs to the town of Omro. The open draw overhangs the centre pier, and the projecting sidewalks obstruct navigation and endanger boats passing the bridge.

Remedy proposed.—The projecting sidewalks, or one of them, should be removed, or else spring-pile protections and guides be placed to assist boats to pass safely.

(10) *Bridge at Algoma street, Oshkosh, Wisconsin*, belongs to the city of Oshkosh. The sidewalks of this bridge overhang the pier and endanger boats by projecting into the channel-way.

Remedy proposed.—Remove the projecting sidewalks, or provide suitable guides and protection piles or piers.

(11) *The Chicago, Milwaukee, and Saint Paul Railroad Bridge at Oshkosh* has but a single draw-span, of 60 feet, which is insufficient to accommodate the steamboats and sailing-vessels. Another opening is needed.

(12) *Highway Bridge at Light street, Oshkosh, Wisconsin*, is owned by the city. The draw, when open, overhangs the piers, and projects into the channel, endangering boats passing through the opening. Proper guards are needed, or the projections should be removed.

(13) *Highway Bridge at Main street, Oshkosh, Wisconsin.*—The draw, when open, overhangs the pier. Same remedy proposed as for similar cases above mentioned.

(14) *The Chicago and Northwestern Railroad Bridge at Oshkosh, Wisconsin*, belongs to the Chicago and Northwestern Railroad Company. This

bridge has a double opening, but only one of them can be used, the other being closed by a platform and track for the draw. The one in use is only 56 feet wide, and is placed too near the right bank. Complaints are made by steamboat-men of its location. It is difficult of access, and more so because alongshore is taken up by rafts for quite a distance out.

Remedy proposed.—There is abundant room for both rafts and channel. The rafts do not project out an unreasonable distance, so that the railroad company should be the party to accommodate navigation. A double draw, of 60 feet span each, is required about the middle of the river. The tracing* herewith gives the location of the five Oshkosh bridges.

(15) *The Chicago and Northwestern Railroad Bridge over the Neenah Outlet to Lake Winnebago* is a pile bridge, and is without a draw. This bridge has entirely destroyed the navigation to the town of Neenah, and to and from the mills located there. The company has paid no attention to the repeated demands of the citizens of Appleton and Neenah and the boatmen for a navigable pass or draw through this bridge. The bridge is not over the through channel of navigation, but is over part of the navigable waters of the United States, and deprives the citizens of the use of facilities for water transportation they would otherwise have.

Recommendations.—It is recommended that the railroad company be compelled to put a draw in this bridge, and remove any obstructions to navigation they may have placed in the former channel of this part of the Fox River.

(16, 17, 18) The following bridges *over the Menasha Canal* have insufficient draw-spans, which should be widened to 60 feet: Upper Highway bridge, draw 49.5 feet wide; Lower Highway bridge, draw 49.9 feet wide; Milwaukee and Northern Railroad bridge, draw 50 feet wide.

(19) *Milwaukee and Northern Railroad Bridge just above the Appleton upper dam* is a serious obstruction to navigation. The piers are all oblique to the current, and dams it back so as to cause a rapid current through the draws and piers, which at high water is much increased by the "draw" over the dam just below it. Owing to complaints by boatmen, the company heretofore agreed to extend the pier next to the north channel 75 to 100 feet up stream, to control the oblique current, and to assist in cutting off the point at the right bank of the river, to facilitate access to the right or south draw. The company failed to make these changes. The location is a very bad one, and the construction is objectionable throughout.

Recommendations.—It is recommended that the company be required to enlarge the water-way through its narrow spans on the left of the draw, to lessen the damming up effect of the bridge, and to extend the centre or draw pier at least 150 feet up stream, to cut off the oblique current across the head of this pier, and to serve as a guide for boats passing the right draw-opening.

(20) *The highway bridge across the upper canal at Appleton*, owned by the city of Appleton, is dilapidated, and has an opening of only 47½ feet in width. When rebuilt it should have a draw 60 feet wide.

(21) *The bridge of the Milwaukee, Lake Shore, and Western Railroad immediately below the Appleton third lock* crosses the channel obliquely,

*Tracing omitted.

and the draw is difficult of access to boats coming out of the lock. The span of the draw-bridge is 80 feet, while the clear opening perpendicular to the channel axis is only 49.8 feet.

Recommendations.—The new lock at this point will cause the left opening to be the one used by boats. This should be increased in width of span to at least 60 feet perpendicular to the channel axis. The changes should be required made only when the location of the new lock is definitely fixed, to avoid inflicting unnecessary expense upon the railroad company.

The Wisconsin Central Railroad has removed its bridge from across the Menasha Canal, but left the piers standing in the channel as dangerous obstructions. This company should be compelled to remove these piers to a depth of 8 feet below extreme low water in the canal.

(8*a*) *Highway bridge across Upper Fox River, about one mile below the city of Berlin*, belongs jointly to the city of Berlin and the town of Aurora, Waushara County, Wisconsin. This bridge is located just below a bend in the river, and at a point where the channel crosses from the left to the right bank. The current is oblique to the open draw. The bridge is especially dangerous at high water, when the current is considerable, at which time it is nearly impracticable for boats to pass down stream without striking the piers or draw.

Remedy proposed.—The location of the bridge should be changed so that the piers of the opening shall be parallel with the current or channel. The draw-span should be at least 60 feet clear opening when measured perpendicular to the axis of the channel, and the opening should be protected by guide-piles, to assist boats in passing the draw at high water.

This report is accompanied by tracings* of the bridges mentioned, numbered as in the report.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR THOMAS H. HANDBURY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., January 6, 1885.

GENERAL: To comply with the instructions contained in General Orders No. 13, dated Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, I have the honor to report as follows concerning the bridges, causeways, or structures now erected or in process of erection that do or will interfere with the free navigation of the rivers now temporarily in my charge. It is proper for me to state at this point that the data for this report were collected under the direction of Maj. W. H. H. Benyaurd, Corps of Engineers, who is in permanent charge of the improvement of these rivers, but at this time absent on account of ill health.

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*Tracings omitted.

CALUMET RIVER, ILLINOIS.

This river empties into Lake Michigan near its southern extremity, and about 12 miles south of the mouth of the Chicago River. From its mouth to the outlet of Calumet Lake, a distance of 6½ miles, it is crossed by four wagon-road and five railroad bridges, all of which are, in its present state, more or less of obstructions to the commerce of the river. At the mouth of the river the United States has already constructed works to facilitate entrance to it. It is further contemplated, under existing authority from Congress, as soon as certain rights of way can be secured, to enter upon the execution of a project for the improvement of the navigation of the river over the distance mentioned, which will necessitate radical changes in its course at certain localities and in its character throughout. This project is outlined in a report, under date of October 6, 1882, of a Board of Engineer Officers constituted in compliance with certain requirements of the river and harbor act of August 2, 1882. The report is published in Senate Ex. Doc. No. 9, Forty-seventh Congress, second session.

The suggestions which follow in regard to the changes necessary in these bridges, in order that they may cause the least practicable inconvenience to the commerce of the river, without material detriment to the commerce over them, have reference to the condition of the river when the project for its improvement above referred to has been fully carried out.

It is evident, from the rapid increase in the amount of capital being invested in this vicinity, that the commerce of this river will at no very distant day tax its entire capacity. The necessary obstructions to its free navigation should therefore be reduced to a minimum.

The minimum width of channel, as fixed by the project, is assumed at 200 feet. Considering the character and importance of the commerce, it could very justly demand a clear opening of at least 60 feet on each side of the draw-pier of all bridges placed over the river.

Accompanying this report are eleven tracings,* one being from a map showing the general course of Calumet River, the remaining ten being drawings showing bridges, &c., over the same.

Commencing at the mouth of the river and going up, the first bridge met is at Ninety-second street, South Chicago. (See Plate II.) This is an iron-truss wagon-road bridge, with sidewalks on both sides for foot-passengers. It was built in 1883, and is now a good, substantial structure. There are two draw-openings, each about 73 feet wide in the clear. One of these only is at present available. On the completion of the projected improvement of the river, both openings can be used. The approaches to the openings will be reasonably fair. It is not thought that any change will be necessary in this structure.

Bridge No. 2 (Plate III) is at Ninety-fifth street. It is a wagon-road wooden bridge, with a draw-opening of about 53 feet in the clear. The arrangements for opening and closing this bridge are of a very primitive character; one end of the movable part rests upon a pontoon, or scow, while the other rests upon piles, upon which a pivot is arranged, around which this part is made to turn. A cluster of piles is driven near each of the two shores. To one of these one end of a chain is made fast; it then passes over a windlass situated upon the pontoon, and from thence to the other cluster of piles. The bridge is manœuvred

*Tracings omitted.

by turning the windlass. Arrangements are made on the pontoon for adjusting the level of the bridge to correspond to the height of the water in the river. This bridge was built in 1875, as a temporary expedient for crossing the river at this point. Its serviceable period is about at an end. The necessities of its own traffic will soon require that it be replaced by another and more commodious and permanent structure.

So far as the necessities of navigation are concerned, it is thought that a structure such as the one now at Ninety-second street would fulfil all the essential conditions at this point.

At the next point at which we find the navigation of the river obstructed there are three railroad bridges, in immediate proximity to each other. Nos. 3, 4, and 5, (Plates IV, V, VI,) belonging, respectively, to the Baltimore and Ohio, Lake Shore and Michigan Southern, and Pittsburgh, and Fort Wayne railways. These are all substantial iron pivot-draw bridges. They are so arranged as to give but one opening to navigation, of a width of only 60 feet. In neither case is the pivot at the centre of the bridge. Their location is such that but one, the Baltimore and Ohio, can be manœuvred independently.

Experience has proven that the present arrangement of these bridges is very much to the detriment of the commerce of the river, causing to it vexatious and expensive delays. With but one opening of 60 feet, it is impracticable for vessels to pass each other at these bridges. The larger class of lake vessels would find great difficulty, under any consideration, in passing them. If such is the case now, the difficulty will be greatly increased as the commerce of the river increases, and long before it assumes the proportions of the present commerce of the Chicago River, these bridges would amount to almost an absolute obstruction to navigation. A radical change in this locality will therefore be necessary.

The most reasonable demand that the commerce of the river could make would be that two openings be provided in this locality, neither to be less than 60 feet in the clear.

Two methods are suggested, (Plate VII,) by either of which the desired change could be effected. The first contemplates that the two outside tracks be made to approach the middle one in the vicinity of the river, and that they all cross on one large bridge, which would provide for the requisite openings on the two sides of the pivot-pier. In the second, the distance between each of the two outside tracks and the centre, in the vicinity of the river, is to be increased, and each to cross on its own bridge. The pivot-piers of these bridges are located on the same straight line, at such distances apart that each bridge can be manœuvred independently of the others. The requisite channel-way for vessels, is to be provided on each side of the line of piers. Should either of these plans be adopted, it would necessitate a slight change in the directions of the dock-lines in this vicinity from those recommended by the Board of Engineers.

The details of these alterations have not been entered into, as it is assumed that for all the purposes of this report it will be sufficient to indicate what is necessary in order that the just demands of the commerce of the river may be met, and in a general way to point out how this may be done, leaving it to those whose province it is to meet these demands at the proper time to prepare the detailed plans for so doing, subject to the approval of the Hon. The Secretary of War.

Since the date of the report of the Board of Engineers, October 6, 1882, a dock-line has been built in the vicinity of these bridges by the Calumet and Chicago Canal and Dock Company, which is within the lines recommended by the Board. (See Plate VII, Figure 2.) Whether this will be an obstruction to navigation or not, will depend upon the modifications made in the proposed dock-lines when the necessary alterations are made in the bridges.

Passing on up the river, the next bridge, No. 6, (Plate VIII,) is at One hundred and sixth street, and the next, No. 7, (Plate IX,) is at Chittenden. These are both wooden wagon-road bridges, of precisely the same construction as bridge No. 2, at Ninety-fifth street, heretofore described. The remarks made in that connection as to changes necessary apply with equal force to these two localities.

Bridge No. 8 (Plate X) is an iron pivot-pier railroad bridge, built by the Western Indiana Railway Company. It provides for two channels for vessels, although but one is at present available. In the clear, these openings are only about 42 feet, much too small for even the present need of the commerce of the river.

The most speedy and economical method of remedying the defects of this bridge would seem to be to replace it by one of longer spans, giving the necessary opening on the two sides of the pivot-pier. It is possible that this pier may be found sufficient for the new structure. The abutment-piers will have to be removed and placed further inshore.

Bridge No. 9 (Plate XI) is the last one on that part of this river on which improvement has been authorized by act of Congress. It is an iron-girder railroad bridge, built by the New York, Chicago, and Saint Louis Railroad Company. It provides for two channel-ways for vessels, only one of which is at present available. The openings are about 52 feet in the clear. To increase these to 60 feet or more, it will be necessary to set the abutments further inshore and increase the length of the bridge accordingly. The present pivot-pier is doubtless sufficient for the new structure.

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Very respectfully, your obedient servant,

THOS. H. HANDBURY,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN D. W. LOCKWOOD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., August 23, 1884.

SIR: In compliance with instructions contained in General Orders No. 13, dated Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report with reference to the railway bridge across the Saint Joseph River near the town of Saint Joseph, Mich.:

The bridge is a pile structure, with two draws of the "jack-knife" pattern, each 60 feet wide in the clear, and distant from each other 280 feet. The south draw has its south abutment about 88 feet distant from the dock-line, which is irregular in direction and makes quite a large reentering at the point where the bridge leaves the shore. Only the south draw is practically of any account at present, as the depth of water in

the north draw is only about 3 or 4 feet, and, up to the 12th instant, it had only been opened once during the present year. The distance from the end of the north pier to the south draw is about 2,200 feet; from the end of the south pier this distance is 1,500 feet.

In storms from the northwest around to southwest the harbor entrance is much exposed, and a heavy sea makes in the channel up to the draw, rendering it difficult for a vessel under sail to make the present narrow opening.

The Board of Engineers that reported on this subject, in June, 1875, recommended substituting for the present south draw a pivot-draw, with clear openings on each side of the pivot of 75 feet. In my report of March 27, 1884, I stated as follows:

> In conclusion, I would state that I can see no way of restoring the harbor to its full capacity of usefulness, or place it in such condition that improvements commensurate with its importance as a harbor of refuge can be safely projected and carried out, except by removing the present bridge entirely.

This was practically the opinion given by the late Major Harwood in his report under date of February 23, 1882, to wit:

> And consider the removal of the bridge and piers to the extent of at least 300 feet from the Saint Joseph Dock-line a necessity to the proper preservation of the harbor, &c.

Further examination has convinced me that so complete a change is hardly necessary; and I would now present the following plan for modification of the bridge, which, in connection with a change in the dock-line, will, I think, do much towards affording a comparatively easy passage of the obstruction which the bridge now constitutes.

(1) To replace the present south draw with a pivot-draw, having clear openings on each side of the pivot of 100 feet. The south abutment to remain as at present. The draw would in this case take up 225 feet, 25 feet being allowed for the pivot.

(2) The dock-line to be changed as represented by full red line on tracing* herewith.

The present draw is defective in several particulars. In the first place, it is too narrow, being only 65 feet wide, for a vessel under sail in bad weather to make the opening with certainty; and, in the second place, it is located too far from the dock-line as this now stands. Should a vessel entering strike the down-stream starling at present, she would in all probability run into the bridge between the south abutment of the draw and the shore, while the remedy for this defect, with the present narrow draw, by advancing the dock-line would be at the expense of dock-room below the bridge, and a vessel laying at the wharf anywhere near the draw would practically close it by reducing the opening. With a pivot-draw (two openings, each 100 feet wide) a vessel entering or leaving the harbor would have the choice of taking either passage, but as the worst storms here are usually from the northwest, the south opening would be the one generally used by vessels entering, and on this account I would have the down-stream starling make a greater angle with the bridge on the south side than the present one does, in order to make the passage going in as easy as possible.

The proposed modification of the bridge, together with the change in dock-line recommended in connection therewith, are shown on the tracing* herewith.

Should the bridge be modified as before explained and the south dock-

*Tracing omitted.

line advanced, then the needed improvements at this harbor could be carried to completion. The present plan of work under the appropriation of July 5, 1884, is to rebuild the north pier, from the angle "A" to the point marked "B," on a line parallel to the south pier. The part to be rebuilt is in a tumble-down condition, and cannot be expected to stand much longer. From the point "B" a line of revetment could then be built parallel to the new south dock-line, and the north side of this new channel having been dredged out, there would then exist a condition of affairs that would give to the harbor something like its former value and importance as a harbor of refuge.

The regular dock for steamers at Saint Joseph is just below the railway bridge, and any radical changes that might be made in the approach to the draw to facilitate its passage going in would materially encroach upon the present wharf privileges. The most that I would recommend, therefore, in the way of construction for the guiding of water-craft through the draw at present, would be the putting in of two or more clusters of fender-piles on the south down-stream side of the draw, or a fender-pier extending 30 feet down stream, making an angle of about 70 degrees with the line of the bridge.

Very respectfully, your obedient servant,

D. W. LOCKWOOD,
Captain of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 15, 1884.

SIR: I have the honor to submit the following report in accordance with the provisions of section 2 of the river and harbor act of July 5, 1884:

* * * * * * *

The appended report by Mr. B. H. Muehle, assistant engineer, * * * covers the cases where "bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation," and suggests the best mode of controlling such obstructions as now exist and preventing future constructions which may be in the nature of obstructions.

I find myself quite unable to suggest the form of legislation that may be desirable to accomplish the desired object, and the difficulty is greatly magnified by the fact that the business transacted upon this comparatively narrow stream is so great as to render almost impracticable any remedial measures which shall not carry with them considerable hardship in individual cases. However, I concur in Mr. Muehle's suggestion that whatever legislation is attempted should look to the establishment of dock and boom lines by the United States authorities, (probably in conjunction with the State or local authorities,) which should afterwards govern all concerned, with sufficient penalties for infractions of the law.

Very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers, Bvt. Brig. Gen., U. S. A.

To the CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. B. H. MUEHLE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 10, 1884.

GENERAL: In compliance with your instructions, dated October 21, 1884, to report "in regard to existing or proposed obstructions * * * in or pertaining to Saginaw River," &c., I now have the honor to make the following report:

* * * * * * *

(2) The present project for improving Saginaw River, which consists of making a channel of 12 feet depth from the head of the river to the Portsmouth Bridge, Bay City, and of 14 feet thence to Saginaw Bay, provides for a channel 200 feet wide. In laying out the lines of proposed channel it has appeared desirable, in most localities where navigation is obstructed by bars or shoals, to establish these lines so as to connect the deep water above and below each shoal as straight and direct as possible. In such cases some of the mill-booms or store-booms may be considered obstructions in the prosecution of the project of improvement, even though they were located and built by their owners before new channel-lines were projected by the Government. Those which are at present within the boundary lines of projected channels are located as follows: (*a*) A mill-boom at East Saginaw, below the Flint-Pere Marquette Railroad bridge, used for storage of logs, and now owned by the railroad company. This obstruction will soon be removed, as the company proposes to pull the boom-piles, in connection with the extension of their new railroad dock. (*b*) A sheer-boom along the east shore of Willow Island, put there by the Tittabawassee Boom Company, for the convenience of rafts passing around the curve in the channel; and (*c*) a store-boom, belonging to the same company, along the west shore of the river above the mouth of Sheboygan Creek, which boom for a distance of several hundred feet encroaches on the natural channel of 12 feet in depth.

This question of location of booms, where they may conflict with the project of channel improvement under United States authority, came up three years ago, at the time the preliminary examination of the entire river was made, and it was ascertained from the president of the boom company that his company would be willing at any time to locate or move their booms in accordance with such lines of channel as are now or may hereafter be determined on by the United States Engineer Department in the prosecution of the work of river improvement.

(3) The Saginaw River is spanned by nine bridges, as follows: Four road bridges and two railroad bridges at Saginaw City and East Saginaw, and two road bridges and one railroad bridge at Bay City. Neither of these can be considered as interfering with free and safe navigation, except in a general sense, upon the hypothesis that all bridges are obstructions to some extent, and are built wherever the necessity for safe intercommunication between two shores of a river is greater than the inconvenience or damage to the navigation of the stream. The bridges spanning Saginaw River were all built under State authority, with their draw-spans where they are most convenient to the shipping and across the best channel to be found at the time the bridges were constructed. It does not appear that either of these bridges will interfere with the establishment of new channel-lines under the present project of river improvement.

(4) Paramount in importance to the location of booms and bridges in reference to projects of river improvement is the location and construction of lumber-docks by private parties owning mill property upon the shores of Saginaw River. In the absence of any authority vested in the United States Engineer Department to regulate the location of lumber-docks in accordance with certain plans of river improvement, mill-owners have always built and extended their docks out into the river wherever and as far as they needed the facilities for storing and shipping the products of their mills, regardless of how far these structures might encroach upon the navigable channel of the river or interfere with present or future projects on the part of the United States for the improvement of such channel.

Where mills are located on directly opposite sides of the river, notably in the cities of Saginaw, East Saginaw, and Bay City, the building of lumber-docks out into the river in this arbitrary manner has in many localities narrowed up the navigable channel to an extent which is likely to, and in some cases does, interfere with the preparation and execution of a general project for the permanent improvement of the river.

The local authorities of the cities above named have prescribed certain dock-lines up to which lumber-docks may be built, but as these lines were not determined in conformity with any Government project, they cannot be adopted or considered of value by the United States Engineer Department.

All lumber-docks on the Saginaw River being constructed with a view to permanency regarding location as well as stability and strength, it would be difficult now to induce or force their owners to remove existing structures, hence it is deemed unnecessary to enumerate localities where lumber-docks do or may interfere with present or future projects of improvement by the United States in aid of the navigation of Saginaw River. But inasmuch as the lumber business increases every season, and more facilities for storing and handling lumber are constantly required, and as the mill-owners themselves are interested in all Government improvements in aid of navigation, it seems appropriate that the United States Engineer Department should be given jurisdiction over the location and construction of all docks built or proposed to be built on the Saginaw River adjacent to the navigable channel, as well as over the location of booms and bridges. By means of such authority on the part of the United States, the arbitrary encroachment on the river channel by docks and booms could in future be checked, while, on the other hand, many mill-owners would be enabled to extend their docks so as to come up to an established dock-line, which may be determined in connection with the general improvement of the river by the United States.

There are but few reaches of the river where, under the general project of improvement now in force, new channel-lines have yet been definitely determined upon, and it would greatly facilitate the work of projecting details for future operations if the question of authority could be fixed by legal enactment before the beginning of the next working season, or in connection with appropriations now pending in Congress. Such authority neeed not necessarily be a hardship to mill-owners, except in a very few instances, and it can be readily seen that a certain co-operation between the Government engineers and the parties directly interested in the river improvement, by making public and private projects upon a general system to be prescribed by the Engineer Department and adopted by the mill-owners, cannot fail to be beneficial to the latter, while the building and extension of private docks and booms on established lines will greatly assist in the economical execution of Government projects.

Very respectfully, your obedient servant,

B. H. MUEHLE,
Assistant Engineer.

Gen. O. M. POE,
Lieut. Col. of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL G. H. MENDELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., January 7, 1885.

GENERAL: The following report is respectfully submitted on the subjects referred to in General Orders No. 13, Headquarters Corps of Engineers, July 23, 1884, and in the act of Congress of July 5, 1884.

There are two bridges over the channel of Oakland Harbor, know as the Webster Street and the Alice Street bridges, respectively, both having double draw-openings. The former bridge is occupied by a railroad and by a highway, and the latter by a railroad only. The draw in the former is 82 feet in the clear, and in the latter the draw is 79 feet in the clear. The bridges are about 900 feet apart, and are both situated above the sites of the main wharves of Oakland. Few vessels pass these draws. Owing to the small depth at the wharf or wharves situated above the bridges, the vessels trading at these wharves are small and of light draught. These vessels, so far as is known, have no difficulty in passing the draws. Some vessels of larger draught and some sea-going vessels pass one or both of these draws, to find position in which to lay up when business fails for them.

The width of draw in these bridges, while not now a subject of complaint, is unquestionably too small to permit a free and convenient passage to vessels which may reasonably be expected to be employed on

the waters of Oakland Harbor, when the improvement of the harbor now in progress shall be completed or considerably advanced. At some time in the future a width of draw of 150 feet will probably be necessary. In order to afford this width, it will be necessary to reconstruct these bridges. It is hardly probable that this increased width will be required for four or five years. It is greatly dependent upon the progress of the harbor improvement, and this depends upon the amounts of money appropriated by Congress. Therefore, no time can be definitely set for a future necessity for increased width of draw.

No other bridges situated within the limits of the operations of this office are known to be obstructions to free navigation of the waters which they span.

* * * * * * *

Very respectfully, your obedient servant,

G. H. MENDELL,
Lieut. Col., Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. A. JONES, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., February 7, 1885.

SIR: I have the honor to submit report called for in Special Orders No. 13, Headquarters Corps of Engineers, 1884, concerning the district under my charge.

It is made up from information obtained by Captain Powell, before my arrival here; from a hasty examination of the Snake River bridge on the Northern Pacific Railroad at Ainsworth, Washington Territory, and the bridges over the Yamhill River; since the receipt of telegram of the 31st ultimo, calling for a report immediately.

UPPER WILLAMETTE RIVER.

Captain E. C. Gove, of the snag-boat "Corvallis," reports that obstructions exist on the river as follows:

At Springfield, six miles above Eugene, a bridge, (draw.)
At Eugene, a county-road bridge, (draw.)
Two miles below Eugene, a wire ferry-cable.
At Harrisburg, a railroad bridge.
At Harrisburg, a wire ferry-cable.
At Alford's Chute, a rope ferry-cable.
At Centennial Chute, a rope ferry-cable.
At mouth East Channel a rope ferry-cable.
Three miles above Corvallis, a wire ferry-cable.
At Albany, a wire ferry-cable.
At Buena Vista, a wire ferry-cable.
At Leobolis Ferry, a rope ferry-cable.

The wire ferry-cables mentioned above are placed on high poles, one on each side of the river, and during low stages of water are left quite slack, which causes them to fall very low in the centre. At high stages of the river they are hauled out taut, which raises them in the centre; but at very high stages of river they will then be liable to the catch smoke-stacks or pilot-houses of passing steamboats. In such cases the steamboat must either cut the cable or wait until the owners come and lower it. Again, when the river is low and the cables are slack, any sudden rise in the river, and for which the owners would be unprepared, would place steamboats in danger of them.

With regard to the rope ferry-cables; they are low down, and when steamboats approach "the whistle is blown for the owners, (who are never near, as every one crossing on them ferry themselves over,) and if they do not come, they either have to send a man ashore to let go the cable or run through it."

Concerning the railroad bridge at Harrisburg; it is a draw-bridge, with draw-spans of 125 feet each. The piers are cribs filled with stone. The approaches to the draw are pile trestles, with bents 16 feet open. Whole length of bridge, including trestle-work, 950 feet. Height of floor-timbers above high water, 2 feet.

E. W. Spencer, master and owner of the steamboat Salem says of this bridge:

> The last time I passed through the draw was in the spring of 1877.
>
> Captain James Miller made a few trips in the winter of 1878. I am sure no boats have passed through the draw since.
>
> We passed through the South Span ascending and descending. The passage was never safe, and is now choked by a sand or gravel bar, formed three years ago.
>
> The deep water is now under the bridge, near the north bank of the river.
>
> I examined the draw last fall, and considered it such an obstruction that I would not attempt the passage with my boat.
>
> The east span of the draw has never been safe, on account of a strong current sweeping across the stream from the east side; so we never ventured on that side.
>
> The chimney of the *Salem* is 41 feet above water-mark when light.
>
> A new draw must be put in across the present deep channel. The sooner the better, as freight-charges are from Eugene City to Portland double those from Harrisburg, and the railroad is the cause of it.

COWLITZ RIVER.

There is one railroad bridge and two wire-rope ferries over the navigable portion of this river.

The bridge belongs to the Northern Pacific Railroad. It is a Howe truss, with two spans of 200 feet length. Whole length of bridge, 450 feet. It is carried by crib-abutments and one crib-pier. The bottom of the girders is 45½ feet above low-water mark, and 17½ feet above the high-water mark of 1876.

Mr. R. A. Habersham, assistant engineer, states:

> As to the best way of removing the obstructions reported, I approve Captain Spencer's plan. At the Harrisburg Bridge, viz: Building a new draw over the deep channel, and the railroad company should be required, if possible, to maintain the channel in its present place by means of training-dikes and bank-revetments.

UPPER COLUMBIA RIVER.

No obstructions are reported.

SNAKE RIVER.

There is a railroad drawbridge, of the Northern Pacific Railroad, over this river at Ainsworth, Washington Territory, and also eight wire ferry-cables between Ainsworth and Lewiston.

Steamboat-men report that these ferries form no obstruction to navigation.

The railroad bridge at Ainsworth is 1,574 feet long, an dconsists of eight iron-truss spans, resting in granite piers and abutments. Six spans are fixed, and two are covered by the drawbridge. The clear distance between the draw-spans at low water is 152 feet.

I do not consider the bridge an obstruction to navigation.

CLEARWATER RIVER.

There are three wire-rope ferries within 7 miles of the mouth of the river, at Lewiston.

At present they form no obstruction to navigation.

YAMHILL RIVER.

I submit report of Mr. Richard M. Tabor, assistant engineer:

PORTLAND, OREG., *February* 6, 1885.

SIR: In accordance with your instructions, I proceeded to the Yamhill River, on the Oergon Railway and Navigation Company's steamer Orient, on the 4th instant, to examine bridges. The cantilever bridge over that river at Dayton is 40 feet 4 inches clear span, and 41 feet above low water to springing of cantilevers. When they are open a space of 16 feet is obtained for passage of steamers' smoke-stacks. The *Orient* passed through, up and down, without much trouble, although there was a width of only 3 feet to spare for her guards to clear.

The Narrow-gauge Railroad Bridge, 3 miles above Dayton, is a fixed truss bridge, 130 feet wide and 80 feet high above low water. Six hundred yards above this railroad bridge is the county-road bridge, which is a truss bridge, 59 feet 6 inches above low water, and 120 feet wide. The *Orient* could not pass under it at that stage of water, her smoke-stack being 18 inches too high, and she dropped back until a lower stage of water, which was then 15 feet above low-water level. The *Orient* is 150 feet long over all, 37 feet 4 inches across her guards, and the top of her smoke-stack is 46 feet 3 inches above the water. She draws 3 feet when full laden to 250 tons. This is the only boat that has run up the Yamhill for three or four years. None have run up as far as La Fayette for the past four years, until this winter, when the *Orient* made two trips to that point. No boat has run above La Fayette for the last six years, although small steamers can get up as far as McMinnville with a good stage of water. This does not cause any complaint, as the freight is now all carried by rail, since the opening of the narrow-gauge. A single telegraph-wire crosses the Yamhill just below the Narrow-gauge Railroad bridge at La Fayette, at height of 64 feet above low water.

The Yamhill River rises at times 39 feet above low water, and falls and rises very rapidly.

I have the honor to be, sir, your obedient servant,

RICHARD M. TABOR,
Assistant Engineer.

Maj. W. A. JONES,
Corps of Engineers, U. S. A.

The bridges over the Willamette, the Yamhill, and the Cowlitz are obstructions to navigation, but in the short time at my disposal I am not prepared to suggest methods of altering or constructing said bridges.

The wire-rope ferries on the Cowlitz can be altered by raising the cables higher.

The same may be said of those on the Willamette River.

Very respectfully, your obedient servant,

W. A. JONES,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES F. POWELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., December 12, 1884.

SIR: I have the honor to submit the following * * * report of certain structures which interfere with navigation, and the best means of changing them for prevention of such obstruction. To these

reports I have added some statements about dumping material into navigable waters or their tributaries.

* * * * * * *

OBSTRUCTING BRIDGES OVER WATERS OF YAQUINA BAY, OREGON.

The Willamette Valley and Coast Railroad Company have built in the last year, and now maintain, low fixed bridges over the tide-water sloughs, Boone's, Depot, and Olallie, of Yaquina Bay or River and near the entrance to the sloughs.

There is a county wagon-road bridge over Depot Slough, about 1½ miles from its mouth.

Boone's Slough makes off from the north side of the river, about 8½ miles above Newport, the port at the entrance to the bay, runs around an island and back into the river, under the name of McGee's Slough.

About twelve miles above Newport, Depot Slough extends northward almost to the Siletz Indian Reservation. It drains quite an extent of country, which contains some excellent ranches and most of the available timber on the waters of the Yaquina. There is a saw-mill above the county bridge, to which a small schooner has been for lumber in former years. The railroad bridge is next above Toledo, a small landing one-half mile up the slough.

Olallie Slough is about parallel to Depot Slough, and one mile above it. The slough has been ascended several times for over a mile by the United States tug Wright, drawing 7 feet. The Government has heretofore moored its floating-plant, except the tug, up the slough when work was suspended. The stone-barges can be taken under the bridge, but not the derrick-scow nor pile-driver.

All these bridges are wood, resting on pile-bents. The lower chords of the spans are about 5 feet above the highest tide-level. The mean rise of tide is 7 feet.

The railroad bridges at Boone's and Depot sloughs have 20-feet openings over the channel. The Olallie Slough bridge has a 30-feet opening.

The requirements of present commerce on those sloughs are not pressing, and the obstructions do not now greatly inconvenience any one. But the sloughs are easily navigable at high tide from one-half to two miles by vessels of 6 and 7 feet draught.

Boone's and McGee's sloughs are so shallow and unimportant that a change in the railroad bridges over them is not deemed necessary; but at Depot and Olallie sloughs I think movable spans giving 40 feet clear width of opening should be provided.

OBSTRUCTING BRIDGES ACROSS THE LOWER WILLAMETTE RIVER, OREGON.

These are two unfinished bridges at Portland, and below the head of ship-navigation. One is the Morrison Street wagon bridge, and the other is the North Pacific Railroad bridge. The former consists of a number of piers, some of them submerged; and the latter, of two large clusters of piles, as rest and protection piers above and below an intended pivot-pier. These structures, especially the Morrison Street ones, are a menace and danger to navigation, and should be wholly removed.

A history of these unfinished bridges, showing their degree as obstructions and their legal status, is given in the reports of the Chief of Engineers, page 2657, for 1882; 2003, for 1883, and in Appendix QQ 1, for 1884.

BAR-NET FISHING AT THE MOUTH OF THE COLUMBIA RIVER AND FISH-TRAPS.

A special report on bar-net fishing and fish-traps at and near the mouth of the Columbia was made to the Department last November, (10th.) The report was occasioned by the reference to me of a letter from the Treasury Department.

I had previously called attention in annual reports to an injurious effect on the bar-channels of the net-fishing; and in the special report referred to above I took occasion to say that—

> I have not seen any reason during the last two years to change my opinion of the injurious action of the fishing-nets on the channels; nor that the prevention of the bar-fishing would not retard the salmon-canning interests of the Columbia River.

Pilots have filed written complaints in this office of fish-traps as obstructions to navigation in the Swinomish Slough, a passage of Puget Sound between Seattle and Whatcom, and of traps in the Lower Columbia River one mile below Astoria and at Chinook Point, between Astoria and Fort Canby.

The fish-traps consist of a long lead running out from shore and a large pen or trap at the outer end. Both parts are made of piling, and sometimes the lead, and always the trap, of a net-work of strong materials attached to the piling.

Many of these traps exist in the Lower Columbia River. Their use is being introduced into other rivers of the Oregon and Washington coasts.

A tracing * is sent herewith showing in plan the fish-traps of Baker's Bay, near the mouth of the Columbia, for furnishing a measure of their extent and agency in obstructing or filling up a channel-way.

The traps of Swinomish Slough and near Astoria should be removed.

In the special report of November 10, the fish-traps were described as permeable dikes, which check the current and cause a fill behind them. The following remarks are quoted from that report:

> These traps are coming into extended use in the Columbia River, from the mouth to near the Willamette River, about 100 miles distant. They have been generally located, so far, to the advantage of the main channel; but efforts have been made to build traps where they would be detrimental to it and obstructive to passing vessels.
>
> When requested, I have, as engineer in charge of the improvement of the Lower Columbia River, recommended about the location of a fish-trap. Pilots have prevented, I believe, the building of traps at places where they would encroach upon the ship-channel by threats of the destruction of the traps.
>
> No authority is exercised or delegated by the State in locating or limiting fish-traps. They are built as a right of the land-owner, the same as a public wharf or landing-pier should be.
>
> In order to preserve and maintain the ship-channel, the planting of fish-traps, as the building of other structures in the river, should be under active control of some authority fully advised of present and probable future improvements for navigation of the river and in harmony with the work thereof.

LOG-BOOMS IN NAVIGABLE WATERS.

On the left bank of the Coquille River, Oregon, above Coquille City, the piling of a log-boom has made an extensive shoaling at its site, destroying a river landing and deflecting the current to the opposite shore, causing bank caving and an undesirable change of channel.

On the Willamette River, Oregon, at Portland, a pile log-boom, occupying about one-third of the river's width, has aided in deflecting the

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*Tracing omitted.

river volume to a channel naturally inferior for harbor purposes and those of ship-navigation, thereby causing public improvements to be made to this channel when a different one would otherwise have been more advantageous.

A pile-boom has been built across the mouth of the Dwamish River, Washington. An opening was left for steamboats. The boom has now been abandoned; some of the piles are broken at low water, and form obstructions to navigation. This boom, as well as the one in the Willamette River, should be wholly removed. The latter is now within the corporate limits of Portland. A municipal ordinance requires the removal of portions exterior to an established wharf-line within six years.

DUMPING IN NAVIGABLE WATERS OR THEIR TRIBUTARIES.

It has been my observation that serious detriment to navigation and much expense in improvements therefor have been caused by a dumping in the water-ways of this district of miscellaneous materials from sawdust and sweepings to trees. * * *

The Government is engaged in improvement by snagging operations of six rivers of this engineer district. Most of the snags or pieces of drift-jams are trees washed out from banks or are saw-logs. It is not uncommon, however, to find drift made of tree trunks or stumps which have been cut in two.

On the Coquille River are many bars formed by drift of myrtle, a wood too heavy to float. I have noticed a very bad bar next above the head of present navigation, formed in this way.

Much earth and rock were dumped into Yaquina Bay and River by the railroad construction already referred to. This curtailed, to a small extent it is true, but injuriously, the tidal volume, and doubtless caused some shoaling on the bars. This dumping was not only to make a railroad grade, but sometimes a spoil-bank was formed in the water.

Under date of June 17, 1884, Joseph Thompson, of Toledo, Oreg., wrote me that—

> Parties up the bay, where the channel is narrow, are complaining of the railroad company for depositing so much dirt and rock in the river, and wished me to write to you in regard to the matter.

On August 8, 1884, Mr. B. Morrison wrote me, from Pioneer, Oreg., as follows:

> I am in the grocery business here, and have a farm of land, and the Yaquina River runs through my place. Officers of the O. P. R. R. and others are filling up the channel of Yaquina River with rock and timber and obstructing the navigation thereof. Steamboats have run to my place, and now I cannot receive goods with a row-boat, and it costs me extra for teams and depreciates the value of my place $1,800.

On August 6, 1884, Mr. George C. Boswell, of Elk City, Oreg., wrote me as follows:

> I wish to inform you that the O. P. R. R. is filling up the river above Elk, a navigable river, meandered above where they are doing the damage, and it is impossible for me to get out with my scow at present. There was a great travel on this part of the river before they filled it with rock and timber.
> * * * * * * *
> If there is $40,000 appropriation for Yaquina Bay, why not keep the river open, as we have a good sand-rock quarry here, and working men in it dressing stone, and expect to ship with scows to Yaquina schooners.

The wasting of sawdust in the Lower Willamette and Columbia rivers has been quite common.

A written complaint was lately made by a vessel-master of the injurious action in the channel of a sawdust dumping in the river at an Astoria mill. Near Portland some of the mills have erected frail bulkheads behind which to place their sawdust.

There is an Oregon statute prohibiting the dumping of sawdust in the rivers below the Cascades and the Willamette Falls, but practically the law is of little avail, if any at all.

Perhaps the most aggravated case of river dumping in this district is at Portland and East Portland. The worst bar of the river ship-channel is next below these cities. Dredging has been prosecuted here to a considerable extent. Cans, matting, shoes, ashes, and other refuse have been frequently found in the dredging.

Masters of steam-vessels have complained about floating harbor *débris* as endangering the wheels of their craft when passing.

It has been noticed when Portland wharves are rebuilt that a considerable part of the old material is disposed of in the river, and that boxes, crates, packing material, &c., are sometimes thrown into the river or on the bank where high water will float them.

Reports have also been made of a deliberate dumping over open wharves from carts at night.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Captain of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.